Public Works Engineers' Yearbook

1939

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1939

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FOREWORD

THE PUBLIC works officials of cities, counties, states, and the federal government for many years have met together annually to share their experiences and cooperate in seeking solutions to their common problems. Since 1935 the annual meeting has been designated the Public Works Congress, and for the past two years it has been held under the sponsorship of the American Public Works Association. The 1938 Public Works Congress was held in New York City in October; its proceedings are included in the present volume.

In addition to these proceedings, however, this 1939 *Public Works Engineers' Yearbook* contains a great amount of material which was prepared especially for it by acknowledged authorities in the fields of discussion. This special material presents a comprehensive review of the significant events and developments in the public works field during the year 1938.

Contents of the present volume can therefore be considered to consist of two major elements, a review and appraisal of developments significant to an official carrying public works responsibilities, and a more detailed discussion of selected problems of current interest. This latter part corresponds closely to the topics given consideration at the 1938 Public Works Congress.

FRANK W. HERRING,
Executive Director

Chicago, Illinois
April, 1939

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PART ONE

PUBLIC WORKS IN 1938:

A REVIEW OF EVENTS AND DEVELOPMENTS

PUBLIC WORKS ADMINISTRATION

Personnel Administration

Harry Fite
Public Administration Service, Chicago, Ill.

The forces which led to an extraordinary revival of interest in civil service legislation in 1937 continued to be effective in 1938. The last year has produced additional merit legislation, but it is particularly noteworthy as a period of consolidation of prior gains. Recent activity in personnel administration in many jurisdictions throughout the country has been devoted to revision of fundamental personnel policies to conform to new principles, and to experimentation with technical procedures.

Recognition of the importance of the personnel problem to public works officials was given in strong terms in the resolution favoring the merit system adopted at the 1937 meeting of the American Public Works Association. At the same time a number of personnel problems which seemed especially significant were discussed. It may prove illuminating to analyze the accomplishments made in the personnel field during 1938 in the light of these problems:

1. The formulation of satisfactory methods for removing incompetents from service under the merit system
2. Development of satisfactory programs of in-service training in public works departments
3. Achievement of career service conditions by improvement of classification plans, increasing promotional opportunities and provision for equitable pay

In so far as extending the merit system is concerned, a steady rate of progress was maintained in 1938. Twenty-four cities adopted civil service for the first time in 1938 and seven others extended its terms to hitherto exempt positions. In Cleveland, for example, civil service was extended to 4,000 positions in the unskilled labor service. The most advanced benchmark of progress, however, was the Executive Order of the President which extended the federal classified service to incorporate 80,000 additional employees. It is estimated

in a study released by the Civil Service Assembly of the United States and Canada that as a result of the year's activities there are now 890 jurisdictions operating under the merit system. In addition 27 states not having formal civil service laws operate certain departments or activities under personnel rules of some kind. As to the public works field specifically, a study made by the American Public Works Association in the course of preparing its publication, *Street Cleaning Practice,* revealed that in 26 of the 94 cities studied competitive examinations are used for selection of all street cleaning personnel.

A Career Service in Public Works Engineering

There was generally much effort devoted to preparation and improvement of position classification plans during 1938. The states which adopted civil service during 1937, Arkansas, Connecticut, Maine, Michigan and Tennessee, were thoroughly occupied with establishing their merit systems on a sound basis. They all were faced with the necessity for preparing classification plans as the first step in this procedure. In addition to the states mentioned, several cities, among them Fargo and Minot, North Dakota; Shorewood and Wauwatosa, Wisconsin; Alameda, California, and Fort Worth, Texas, established classification plans in connection with the installation of their personnel agencies. A number of jurisdictions whose merit laws were of longer standing adopted systematic classification plans for the first time or took steps to improve existing plans. Comprehensive classification surveys of this sort were made in Phoenix, Seattle, Los Angeles County, Sacramento County, Milwaukee County, Minneapolis and Madison during 1938. New York City's Commission undertook a classification job of more limited scope.

The American Society of Civil Engineers also undertook to prepare a model classification for the engineering profession which is designed to divide the engineering field into levels in terms of work performed and in terms of education, knowledge, experience, skill, and other attributes as well. Another classification of engineers was drafted by a committee of the San Francisco Engineering Council. This plan was designed to be a basis for such working conditions in terms of salary and opportunities for advancement as would attract and hold the highest type of engineering personnel.

This widespread effort to improve classification may be regarded

as a definite evidence of progress. In most instances the designers of the new plans clearly understood the relationship between classification and career opportunities, and definitely attempted to produce plans which would promote career service conditions. In view of opinions expressed by individuals in the public works field, an intimation as to the qualifications established by those plans for entry into the engineering field in the public service should be of lively interest to them. Such of the new plans as were examined fail to justify the common fear that the practical engineer with years of experience will be placed at a disadvantage in competing for positions against recent engineering school graduates. In fact the reverse may be the case. Rather than excluding from competition on the basis of lack of education, these plans tend to make a definite period of practical experience mandatory and provide that years of education may be substituted for some but not all of the required experience.

Although individual classification plans might be definitely designed with a view to promoting career opportunities, the size of most government services is such as still to restrict them materially. Consequently the widespread practice of adhering to local residence restrictions in recruiting for public positions has been a very vicious one. Mayor La Guardia attacked the practice vehemently in his speech before the 1938 meeting of the American Public Works Association and stated exceedingly well its disadvantages especially as relating to the field of public works. As he indicated, public works engineering has become so specialized, that to become competent in it a man must make it a lifework. However, before the best qualified personnel will be attracted to public works engineering broader career opportunities must be provided. This means that there must be freedom for interchange of personnel between public jurisdictions.

Unhappily it must be reported that the year 1938 reveals little evidence that local residence restrictions are being abandoned in recruiting for positions in the public works field. Milwaukee and Detroit did depart from them in a few instances. In Milwaukee examinations for Superintendent and Assistant Superintendent of the Milwaukee Water Filtration Plant were thrown open to nationwide competition. The Detroit Civil Service Commission undertook to hold examinations for positions in the Detroit Housing Authority and residence requirements were waived in connection with the

examinations for Housing Manager and for Engineer of Public Housing.

Evidence that opportunities for careers in the public works field are being improved by enhancing promotional opportunities within a single jurisdiction is more abundant. There were numerous announcements during 1938 that career men of long service had been given promotions to important positions in their own municipalities. For example, the newly appointed Superintendent of the Municipal Waterworks in Cincinnati had entered the service over 20 years ago as junior draftsman. In Rochester, New York, two men of 25 years' service with the city were recognized with appointments as Commissioner of Public Works and City Engineer. Mayor La Guardia appointed a career man who had been serving as Deputy Commissioner to the post of Commissioner of Public Works. Other career men were advanced also in the New York Public Works Department in 1938 whenever the necessity to fill important posts arose.

Public Service Training

Impetus furnished by the George Deen program and general interest in the subject led to the establishment of a number of in-service training programs during the year. In at least 11 states, plans have been formulated which involve joint supervision of in-service training activities within the state by the league of municipalities and the vocational education board. Complete details of the program have not been formulated in most of these states. However, in those places in which activity has begun, what seem to be extremely promising approaches are being followed.

Michigan is one of those states which has made relatively rapid progress. A director was appointed to plan and supervise a program and 1938 saw intensive development of training in four fields: fire, police, assessing, and public utility plant operation. In addition, systematic encouragement was given to the expansion of the Wayne University training courses for public employees which include among others a course in municipal sanitation.

A Bureau of Public Service Training was established in the Department of Education in New York State and a well-qualified director appointed to conduct its activities. As a first step an appraisal was made of existing facilities for in-service training. This led to the decision to assist and expand existing programs wherever possible rather than to establish new ones. A short training con-

ference for highway superintendents which included in its scope the subjects of highway administration, materials, construction and maintenance methods and the use of highway equipment was another development in New York during the year.

Among other interesting training ventures conceived during 1938 was the training course for highway department employees which was initiated in Arkansas as part of the George Deen program. This course was of 24 weeks' duration and its curriculum included highway law, public relations, vehicle and equipment maintenance, and clerical procedures. Finally a formal craft apprenticeship training for employees engaged in construction, maintenance and operating activities was developed at the Tennessee Valley Authority.

Other Personnel Developments

Public works officials have not been alone in feeling the necessity for facilitating the removal of incompetents in the public service. Yet no information is at hand that any public bodies grappled systematically with this extremely important problem of the public service during the year. However, in this connection the California League of Municipalities published a model civil service ordinance for council-manager cities which recommended limiting the civil service commission to an advisory function. That is, the commission was to be given no power to reinstate employees removed from their positions by an appointing authority.

New sectors of the personnel front were assailed during 1938 when real activity in accident prevention was launched in a number of jurisdictions. Milwaukee announced savings of $30,000 as a result of its accident prevention work, San Diego appointed a safety committee, and the Chicago Park District provided for systematic accident reporting and safety specifications for each job. Other innovations included the establishment of low-cost hospitalization plans in Toledo, Akron, Cleveland, and San Francisco, and efforts made to regularize employment of public works employees in Two Rivers, Wisconsin and Des Moines, Iowa. Two Rivers pays its outside "seasonal" workers on the basis of a 40-hour week with the same monthly salary throughout the year. Public works employees work a 50-hour week in summer when most of the outside work is done and a 30-hour week during the winter. An agreement was made in Des Moines to provide an annual wage for street department employees based on 240 work days a year.

In general public works officials have no power finally to decide upon the broader aspects of the personnel program of a jurisdiction. The basic outlines of the classification plan, personnel rules relating to removals from the service or salary policy are decided upon by the lawmaking body, the chief executive of the jurisdiction or a civil service commission. Of course, public works officials can and should exert influence on the responsible parties to make determinations that will be in accord with the principles of good personnel administration. However, they can make their most important contributions by sponsoring progressive measures within their own departments and within the limits of their powers to take action. Such positive measures as training programs or employee welfare programs may often be initiated quite feasibly within a single department.

Public Works Planning and Programming

HAROLD MERRILL
National Resources Committee

PUBLIC works planning is at once the simplest and the most complex of all planning problems. It was naturally the first subject studied by the National Planning Board when it was established within the Public Works Administration in 1933. Traditionally, public works planning has been thought of as the preparation of the plans and specifications for bridges, roads, and other works built with public funds, a task which in most instances is readily accomplished by the skilled engineer.

Later, as city planning developed, public works planning came to mean also that individual projects should be planned in relationship to each other. The boulevards, for example, should bear the appropriate relationship to the parks; the freight transportation facilities should be so integrated as to expedite the movement of goods. The units of the school system should be so distributed as to serve the entire population adequately. The plan for public works came to be conceived as a means for coordinating community services

and guiding community growth. This type of public works plan could not be evolved from the use of the slide rule and the application of engineering and economic formulae alone. It required insight into community aspirations and needs and even imaginative genius. When the public works of an entire city came to be considered as a unified whole, problems of emphasis arose. What shall we build? More of this type of facility? Less of that? In what sequence shall projects be undertaken? The search for criteria to weigh alternative courses of action in order to produce a balanced plan began.[1]

One test of need was and is willingness or ability to finance the proposed projects. With limitations on borrowing and tax rates in many cities, it is necessary to schedule improvements far ahead; and this necessity caused the development of 5- or 10-year programs and capital improvement budgets to finance them.

Within recent years there has been world-wide speculation on the possibility of so planning and conducting public works programs as to reduce the amplitude of the upward and downward swings of the cycle of general economic activity. Thus, there has been superimposed on earlier conceptions of public works planning an idea which requires the most astute economic analysis. At the same time, planning becomes nationwide in scope since no individual city or state alone can so conduct its public works program as to have a perceptible effect on fluctuations in the national economy.

In the past decade moves have been made on several fronts in the effort to use public works expenditures to mitigate the severity of the business cycle. Within the federal government, the Public Works Administration and the Works Progress Administration have given an impressive demonstration of nationwide public works activities designed to take up the slack left by the decline of private construction activity. Through the work of these agencies there has gradually been established in the minds of the public a belief that hardships brought about by the fluctuations in economic activity can be reduced by properly planned public action. Along with this there has arisen a popular recognition of a responsibility for the federal government to act in these situations. In other words, it is fair to say that through our democratic procedures the policy has been popularly established that the federal government both can and should

[1] Russell V. N. Black, *Criteria and Planning for Public Works*, National Resources Committee, 1934.

act. This is the most fundamental advance toward public works planning that has occurred; there remains the task of solving the legislative, technical, and administrative problems essential to carry out most effectively the public will.

Public Works and the Business Cycle

To use public works to mitigate the booms and depressions of the business cycle is by no means a simple task. Complex economic questions are involved. To bring more light to bear on these fundamental issues, the National Planning Board in 1933 employed two economists to explore these problems. Their reports [2] were valuable contributions to our fundamental knowledge of the effects of public works expenditures on the functioning of the entire economy and have incidentally stimulated study and research on these problems by economists throughout the nation. Among the significant questions, to which no final answer has been given, are: At what stage of the business cycle should public works outlays be expanded? What volume of expenditure is necessary to have the desired effect? What should be the relationship of public works policy and other governmental policies, such as monetary policy? What is the best way to finance such capital outlays?

The fact that our public works expenditures are made by literally thousands of governmental agencies—federal, state, and local—makes difficult the efforts to minimize fluctuations of business cycles through public works outlays. All these agencies must accelerate or retard their activities simultaneously to secure the greatest effect on general business conditions from these expenditures. Moreover, these different governments must not pursue contradictory fiscal policies so that the action of the federal government will be canceled out by the states and local governments, or vice versa. Within recent years, through federal contribution of some of the costs and responsibilities for public works, which were traditionally borne locally, a beginning has been made toward cooperative action among federal, state, and local authorities dealing with public works. The system of loans and grants by the Public Works Administration has gone far in knitting together the various units of government; the Works

[2] Arthur D. Gayer, *Public Works in Prosperity and Depression,* National Bureau of Economic Research, 1935; John Maurice Clark, *Economics of Planning Public Works,* Government Printing Office, 1935.

Progress Administration, in a different field, has moved in the same direction.

Federal assistance in paying a portion of costs formerly borne entirely by state and local governments has been the principal method for bringing about concurrent action by all units of government. Presumably, by variations in the amounts contributed to state and local agencies by the federal government, the volume of public works outlays may be raised or lowered to meet the necessities of the general economic situation. Thus, an ever-present question is how the costs of particular works shall be divided between the localities, the states, and the federal government. In 1936 the National Resources Committee completed a study of the problem of division of costs and made certain recommendations.[3]

Certain phases of federal-local fiscal relationships in public works were also explored by the Urbanism Committee of the National Resources Committee.[4] Among other things, it was suggested that federal grants and loans to local governments should be made by a federal fiscal agency on projects which had been reviewed and approved by a separate engineering organization. The agreement in the summer of 1938 under which the Reconstruction Finance Corporation undertook to make loans on projects approved by the Public Works Administration constituted an approach toward the practices envisaged by this recommendation.

Advance Programming of Public Works

Acceleration of public works expenditures requires the constant maintenance of a reservoir of projects on which work can be started when occasion demands. Otherwise, unwisely conceived projects will be undertaken; unproductive expenditures will be made. Advance programming of public works was undertaken first in the cities, but in most of these instances the programs grew out of efforts to justify special projects or bond issues, and there was generally no periodic revision of the programs. In the years 1930 and 1931 in Massachusetts, California, Pennsylvania, and Wisconsin, proposals for advance programming of state works to stabilize employment reached the stage of legislative discussion. In 1931 Congress

[3] National Resources Committee, *Public Works Planning,* Government Printing Office, 1936, Part III.

[4] National Resources Committee, *Our Cities,* Government Printing Office, 1937, pp. 80-82.

adopted the Employment Stabilization Act providing for a six-year program of federal public works to be revised annually.

Substantial progress has been made in the last five years in putting into operation the idea of advance programming of public works. Six-year programs of federal works have been prepared and revised annually at the request of the National Resources Committee under the auspices of the Public Works Administration, continuing the work of the Federal Employment Stabilization Board. The Water Resources Committee of the National Resources Committee has served as an agency for the advance planning of federal, state, and local works relating to water.

To stimulate advance programming by states and local governments, the National Resources Committee late in 1934 requested the state planning agencies to aid in securing a quick inventory of public improvement projects. A distinct benefit was realized in directing the attention of local officials to the need for comprehensive and well-balanced plans and programs for community development. Encouraged by the results of the first nation-wide inventory, the National Resources Committee, in July 1936, suggested to all state planning agencies the necessity for and desirability of a revision of the inventory of local and state construction. In the summer of 1938 the National Resources Committee again asked the cooperation of the state planning agencies in preparing a revised program of public works projects. In this work, the National Resources Committee hopes that it can aid the state planning agencies in establishing among state and local agencies the practice of preparing and annually revising six-year programs of public improvement projects parallel with the programs of federal works prepared and annually revised under the Federal Employment Stabilization Act.

Something more in the way of advance preparation than a list of projects described in general terms is necessary, however, if the rate of construction is to be varied with the necessities of the general economic situation. Sites must have been acquired and detailed plans and specifications prepared in advance if the dirt is to fly within a reasonable time after the order to proceed is given. An impressive demonstration of what can be done when these preparations have been made was given by the Public Works Administration in the summer of 1938. With a backlog of applications covering projects on which construction could be started immediately, the

program was inaugurated with a minimum of delay when it became necessary to expand public works activities.

The closely related problem of securing authority to act sufficiently ahead to prepare plans has not yet been so successfully met. Bond issues often cannot be floated unless authorized at elections, and legal safeguards take time. Advance authorization may be used by pressure groups to maintain or increase public construction expenditures in prosperous times as well as to provide quick action in periods of depression.

Public works planning needs to be carried on whether or not public works outlays are used to stabilize the economy. The National Resources Committee has sought to promote comprehensive state and local planning which would assure the development of well-rounded programs of public works. An example of coordinated planning is furnished by the work of its Water Resources Committee in planning for the use and control of the waters of drainage basins. The state planning agencies have made encouraging progress in the development of coordinated plans for state public works. Many of the state boards have succeeded in stimulating renewed activity by local planning agencies. The general acceptance of public works as a means of alleviating the distress of depressions has itself encouraged better state and local planning in order to secure the highest returns from emergency outlays. In turn, comprehensive, long-range state and local planning facilitates the management of public works outlays so as to minimize the fluctuations of the national economy.

The nation thus appears to have accepted the practice of using public works expenditures as a general economic balance wheel. In 1936 the National Resources Committee examined the problem of a national public works policy and outlined a recommended policy. To implement the policy, it suggested (1) the creation of a National Development Administration, based on the existing powers of the Public Works Administration and the Federal Employment Stabilization Office, and (2) a Fiscal Advisory Committee to advise as to the coordination of fiscal policy and public works planning and timing with governmental monetary and credit policies.[5] Recent developments have emphasized the necessity of establishing this coordination on a continuing basis in relation to the trends of business activity and the national income. The President has announced

[5] National Resources Committee, *Public Works Planning,* December 1936.

the establishment of a Fiscal and Monetary Advisory Board, composed of representatives of the chief agencies formulating fiscal and monetary policies: the Secretary of the Treasury, as chairman, the Director of the Budget, the Chairman of the Board of Governors of the Federal Reserve System, and the Chairman of the Advisory Committee of the National Resources Committee. This Board will advise with the President in the development of a federal fiscal and monetary policy to permit the most effective use of public works and other governmental expenditures in raising the national income to the capacity which our resources can sustain.

Federal Six-Year Programming

In order to bring together federal officials concerned with public works and citizens especially qualified to advise on the economics and timing of public construction activities, the National Resources Committee in January 1939 appointed a new technical Public Works Committee, similar to its other technical committees on Water Resources, Land, etc.

Colonel Henry M. Waite was named chairman of the Committee and Frank W. Herring, of the American Public Works Association, vice-chairman. Other members are F. E. Schmitt, *Engineering News-Record;* Otto T. Mallery, member of the Pennsylvania State Planning Board; William Stanley Parker, Construction League of the United States; Frederick J. Lawton, Bureau of the Budget; Corrington Gill, Works Progress Administration; Fred Schnepfe, Public Works Administration; Lowell Chawner, Department of Commerce; A. F. Hinrichs, Department of Labor, and Lt. Col. Paul W. Baade, War Department.

From the beginning of its work as the National Planning Board of the Public Works Administration, a major activity of the Resources Committee has been to urge the advance planning of public works, and to outline a public works policy which would secure the wisest use of the huge funds which our cities, states, and federal government spend annually on public works. It has in the past been engaged in the preparation of six-year programs of federal public works and in stimulating the preparation of similar programs by states and cities, and this new group has been asked to assist the Resources Committee in continuing this work on the federal, state, and local governmental levels.

In addition the new Committee will undertake studies to de-

termine the most effective utilization of state and local public works for stabilizing the construction industry and to analyze the various plans for public construction activities which are directed toward providing employment and increasing the national income.

This work will continue work carried on by the Resources Committee since the abolition of the Federal Stabilization Board which was required to prepare advance public works programs under the Employment Stabilization Act of 1931. That act declared it to be the policy of Congress to develop a reservoir of projects arranged in order of proposed work for a period of six years in advance. The programs prepared by the Federal Employment Stabilization Board proved of great value in the quick development of federal projects at the outset of the work of the Public Works Administration and the appointment of the new technical Public Works Committee is expected to expedite the preparation of such programs by the National Resources Committee and to increase local and state activities in this direction.

Developments in Public Works Organization in 1938

Donald C. Stone

Executive Director, Public Administration Service, Chicago, Ill.

In appraising the year's developments in public works organization it seems fitting to examine the trends in the light of accepted essentials of public works management. Briefly stated, from the standpoint of organization, effective public works administration depends upon the following prerequisites.

Organization Prerequisites

1. The assignment to the public works, or equivalent department or departments, of those functions which are sufficiently alike in terms of purpose, procedure, and requisite technical skills that they can be directed and integrated with maximum effectiveness and efficiency.

2. The establishment of departmental subdivisions pursuant to

an analysis of all activities with respect to their points of similarity and difference to the end that supervisory authority may be clearly allocated and lines of responsibility carefully defined.

3. Provision for single and direct leadership over the department as a whole and over each of its subdivisions, with every supervisory officer charged with a sufficient number of activities to warrant employment of a person competent to deal with the most difficult administrative questions of any of the activities.

4. The determination of positions on the bases of the various classes of work to be performed, with commensurate responsibility and authority vested in each position so that such responsibility and authority flow directly from higher positions to subordinate positions.

5. The restriction of subordinate units to a number small enough to permit the department head to deal personally with the supervisory officers, and to have sufficient knowledge of their viewpoints, weakness, and accomplishments that he may exercise a continuous coordination and control over the entire department. The type of activities, extent of supervision required, complexity of relationships, and capacity of the administrator must all be considered.

6. The establishment of such staff and management agencies in the department (budget, accounting, purchasing, personnel, administrative research) as are necessary to supplement the central staff agencies in providing the department administrator and line supervisors with the essential tools of management. By distinguishing between staff and line activities it is possible to avoid making a staff agency responsible for line activities and vice versa.

Organization is an ever-changing vehicle of management, and thus must be molded continuously through the use of executive orders, bulletins, office memoranda, and, most important of all, through frequent staff and individual conferences. In this way the duties of employees, the relationship between the various units, and the flow of work from one position or unit to another may be understood. Orderly, effective administration requires such knowledge on the part of all who play a role in the process. Thus it is important to avoid a detailed prescription of the organization and management of a public works agency through constitutional, statutory, charter, or ordinance action. Definition of internal organization is part of the task of management itself, and the crystallization by

formal enactment of more than the elementary outlines of organization will obstruct efficient management.[1]

Position of Public Works in Governmental Framework

In this running account of developments during 1938, the scope of activities of public works departments and their position in the general governmental framework of various jurisdictions will perhaps be emphasized to a greater extent than more intimate details of organization for administration, largely because information of the latter sort is not easily available. The proper limits to the sphere of activity of a public works department cannot be stated once and for all. There is wide and justified diversity in the functions dis charged by such departments in various places at the present time. However, it may be interesting to enumerate assignments of functions that have been made to public works departments during the year, to illustrate this very diversity.

Relative to its position in the governmental framework, it must be remembered that a public works department is but one of the administrative agencies established by a government to provide public service. In line with the principles of effective organization set forth above, what such a department does and how it does it must be controlled by the chief executive officer and the lawmaking body of any jurisdiction. Also, best results are achieved when the lawmaking body confines itself to decisions as to public policy, while the chief executive is vested with complete responsibility for execution.

The Federal Scene

The problem of public works management is encountered in its most perplexing form in the federal government. The Report of the President's Committee on Administrative Management, which was the basis for the Reorganization Bill so passionately debated in the last Congress, recognized the necessity for a coordinated and consistent handling of public works matters by the federal government

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[1] A comprehensive treatment of public works organization and management problems appears in two recent documents: *The Management of Municipal Public Works*, published by Public Administration Service, 1939, and *Municipal Public Works Administration*, which serves as the text to an extension course of the same title conducted by the Institute for Training in Municipal Administration. Both organizations are located at 1313 East 60th Street, Chicago.

and proposed the creation of a Department of Public Works. Its functions as outlined would be to advise the President with regard to public works; to design, construct, and maintain large-scale public works which are not incidental to the normal work of other departments, except as their agent on request; to administer federal grants to state or local governments or other agencies for construction purposes; and to gather information with regard to public works standards throughout the nation.

This recommendation is a recognition of the principle that related activities comprising a specific function of government should be grouped, and responsibility for them clearly located, so that there may be coherent leadership and continuous supervision in carrying them out. These conditions have never existed with respect to the public works activities of the federal government, least of all in the recent emergency period during which their magnitude has increased so markedly.

A State Case

Before an activity is assigned to a public works department, careful consideration should be given to the appropriateness of the action. What will be desirable in one place will not be so in another, and thorough study is necessary to determine all the conditioning factors in each case. Unfortunately, however, this procedure is frequently not employed. Often growth in activities is hit-or-miss, or by accretion or default. An interesting illustration in point is the situation which recently existed in Connecticut. A department of public works was established there in 1937 and given control over the "real assets" of the state. As the result of a ruling by the attorney-general the new department assumed control over state highways. This ruling was attacked in the courts and finally the Supreme Court of Errors handed down a decision returning jurisdiction over highway construction and maintenance to the State Highway Department.

County Department Established

A consolidation of public works activities in Westchester County, New York, was made pursuant to the adoption of its new county manager charter. A department of public works was created and the functions grouped under it include all highway activities, the maintenance of county buildings, and the activities formerly discharged by the Westchester Sanitary Commission. This develop-

ment is particularly noteworthy because it is a leading instance of centralization of these activities in a county and because the relationship between the department of public works and the general government of the county is established on sound principles. The head of the department of public works is appointed by the county executive.

Municipal Developments

Most of the reported activity during 1938 follows the recommended pattern of public works agencies outlined above. In Wheeling, West Virginia, a general administrative study of the city government was made by Public Administration Service. With reference to public works organization, a department of public works comprehending all public works activities was recommended and established. This brought together in a single department under the supervision of the City Engineer the following divisions: (1) a Division of Streets and Sewers, (2) a Division of Equipment Maintenance, (3) a Division of Engineering, (4) a Division of Water Supply, and (5) a Division of Electrical Service. It is reported that this system is now thoroughly established and is proving to be entirely satisfactory.

Another development of considerable significance in public works organization took place in Montclair, New Jersey, during the year. Equipment requirements were reduced and effective supervision of these activities was provided for when the activities of refuse collection and disposal were assigned to the Department of Public Works.

Also, in Schenectady, New York, a realignment of public works activities was effected with resulting improvement in operating control and reduced administrative cost. This reorganization was particularly designed to define more satisfactorily the place of public works administration in the general governmental framework.

Originally in Schenectady a Division of Water and a Division of Parks, in addition to the other services which usually come under the grouping of public works, were placed by law under a Commission of Public Service. As a result of the recent reorganization a Department of Water and a Department of Parks and Recreation were established, with the directors reporting directly to the City Manager. The former Department of Public Service became the Department of Engineering and Public Works and the City Engi-

neer was assigned the remaining duties formerly imposed upon the Commissioner of Public Service. This department operates under the general direction of the City Manager.

Separate Agencies Established in Two Cities

Interesting developments are found in Rochester and Pittsburgh where related but not clear-cut public works activities were assigned to other departments. These cases do not violate the organization requirements enumerated above but rather may represent their full application.

The first case, Rochester, New York, created a Department of Commerce parallel to the existing Department of Public Works but charged with some activities often assigned to a public works department. The new department has supervision and control of: (1) enforcement of restrictions pursuant to the zoning ordinance, (2) city-owned markets, terminals, ports, railroads, transportation systems, and all real property owned by the city, (3) inspection of weights and measures, and (4) public relations.

Pittsburgh has taken steps to relieve its public works department of concern with property management. A Bureau of City Property in the Department of Public Works was abolished and its responsibilities were transferred to a new Department of Land and Buildings. City-owned property consisted of 1,600 parcels of real estate, 540 municipal buildings, and 80 residential properties acquired through tax sales. The old Bureau had supervision of the real estate, the residential property, and nine of the municipal buildings, while supervision of the other 531 municipally used buildings was distributed widely among the various departments of the city government.

Special Study Commissions Recommend Reorganizations

In the Boston metropolitan area important public works activities are administered by the Metropolitan District Commission. This Commission, which was formed by merging three independent metropolitan agencies, had never completely solved its problem of organization and hence was made the subject of study by the Special Commission on Taxation and Public Expenditures which reported to the Massachusetts legislature during 1938.

The Commission on Taxation and Public Expenditures recommended a greater degree of centralization of administration for the

District Commission, involving a number of shifts and consolidations of existing agencies. At the time of the study, the Metropolitan District Commission was made up of a Commissioner and four Associate Commissioners, all of whom were vested with administrative responsibilities. Under the Commissioner four divisions were established to handle the work of the Commission: the Water Division, Sewer Division, Divisions of Park Engineering and Park Administration. The Division of Park Administration placed under the same head the functions of operation, maintenance, and policing.

The first specific recommendation of the Commission on Taxation and Public Expenditures was to make the Commissioner of the District its responsible administrative head by making the Commission as a whole simply an advisory body and eliminating its administrative powers. The next was for the creation of a position of Chief Engineer to coordinate the engineering and administrative activities of the Water, Sewer and Park Divisions and to supervise and approve all engineering designs, construction, and operations. A third suggested that all park work other than policing should be unified under a single head, and that the remaining activities of the Metropolitan District Water Supply Commission should be transferred to the Metropolitan District Commission. It was also recommended that all staff services be grouped under a single head in a Division of Business Administration.

This plan of reorganization is directed at locating definitely the initiative for public works activities and assuring effective administration by providing the Commissioner with the freedom of action which a responsible executive must have. Moreover, it would establish a more coherent grouping of activities and eliminate a certain amount of duplication of functions. Finally, it would coordinate all staff functions and definitely locate business management activities which have been very loosely assigned.

The Philadelphia Charter Commission also reported during 1938. Included among its recommendations for far-reaching reforms in the city government as a whole were suggestions for modifications in public works organization. The report states that in Philadelphia centralization of public works activities has been overemphasized to such an extent that activities unlike in terms of purpose, procedure, and requisite technical skills are grouped together in the Public Works Department. The recommended plan of reorganization for the department would effect a regrouping designed to combine only

activities sufficiently alike so that they could be directed and integrated with maximum effectiveness and efficiency.

The Bureaus of City Property, Mechanical Equipment, Lighting and Gas, Water, and Highway Patrol would be removed from the Public Works Department, according to these recommendations. The Bureau of City Property would become the nucleus of a new Department of City Property, which would also include the Bureau of Mechanical Equipment. The present Bureaus of Water and Lighting and Gas (except street and alley lighting) would be transferred to the new Department of Utilities so as to unify all public utility functions in one agency and to facilitate simplified and economical performance of these functions. The Highway Patrol would be assigned to the Department of Public Safety because its work is a police function.

The activities of the Bureau of Street Cleaning, the Bureau of Highways, the Board of Highway Supervisors, the Bureau of Engineering, Surveys and Zoning, and the Board of Surveyors, together with the street lighting work of the Bureau of Lighting and Gas, would be continued in the Public Works Department. It is recommended that to these functions then be added the construction, maintenance, and repair of park highways and icebreaking and dredging. The report of the Commission points out that the addition of park highway construction and maintenance to this department does not actually add a new function; for highways are highways, regardless of where they run and the construction and maintenance of them is the same regardless of whether they are located in parks or elsewhere in the city. Such work is entirely unrelated to park and recreational activities. It is also proposed to transfer icebreaking and dredging to this department because it is recognized that they are essentially public works operating activities.

A special study of government in the City of Atlanta and Fulton County, Georgia, was made during the year by the Consulting Service of the National Municipal League. The report which resulted from this study recommended material changes in organization for public works administration. At the present time the committees of the city council on sanitation, public works and sewers actually administer these functions. Furthermore, there are two independent departments—termed sanitary and construction—which have additional but ill-defined responsibilities for public works activities.

The recommendations of the Report on the Government of At-

lanta and Fulton County were pointed at providing a remedy for this chaotic state of affairs. The abolition of the three council committees as administrative agencies was strongly urged. In addition a plan was formulated for centralized administration of public works by a single department under a qualified director. It was suggested that the work of this department be distributed among three divisions: (1) sanitation (2) streets, sewers and bridge repairs, and (3) public buildings. According to the latest advice, however, no steps have been taken locally actually to initiate any of the recommended reforms.

PUBLIC WORKS ENGINEERING

Streets and Roads

GEORGE H. SANDENBURGH
City Engineer, Ann Arbor, Mich.

Chairman of and Reporting in Collaboration with the Committee on Street Paving, Construction, Design, and Maintenance *

DEVELOPMENTS IN CONCRETE STREETS

THERE has been a continuous improvement in concrete street pavement design and construction since the first pavements were built. Although there are concrete pavements in use which date back as far as 1893, most of the progress has occurred in the last 25 years. During that time concrete pavement design has changed from the rule-of-thumb and trial-and-error method to the use of formulas developed through research and experience which enable the engineer to design pavements for any given load. During this same period concrete pavement construction has changed from a hand operation with comparatively crude equipment and methods of control to a highly mechanized and carefully controlled operation in which little is left to chance.

These changes have developed so gradually that it is difficult to enumerate the specific improvements of any one year. The 1938 Yearbook contains a very complete report of the accepted practice in the design and construction of concrete pavement. In view of the fact that good practice today is practically the same as when that report was prepared, a review of that material would be needless repetition. Therefore, this report will be confined to the more important trends in construction and design as evidenced by their increased acceptance and use during the past year.

* COMMITTEE ON STREET PAVING, CONSTRUCTION, DESIGN AND MAINTENANCE, 1939

George H. Sandenburgh, Chmn. . . . . *Ann Arbor, Mich.*
Arvid Anton Anderson. . . . *Chicago, Ill.*
Robert B. Brooks. . . . . . *St. Louis, Mo.*
George Byrum, Jr. . . . . *Birmingham, Ala.*
Walter N. Frickstad. . . . *Oakland, Calif.*
Prevost Hubbard. . . . *New York, N. Y.*
E. L. Knebes. . . . . *Milwaukee, Wis.*
George H. Ruhling. . . . . . *Lansing, Mich.*
George F. Schlesinger. . . . . *Washington, D. C.*
William B. Shafer. . . . . . . *Pittsburgh, Pa.*
Hugh W. Skidmore. . . . . . . *Chicago, Ill.*
Nathan L. Smith. . . . . *Baltimore, Md.*

DESIGN THICKNESS

In the past, cities usually had one standard thickness which was used indiscriminately on all concrete street pavement construction regardless of the difference in character and volume of the traffic on the various streets. Today a number of cities have adopted two or more standard cross-section designs based on frequency and weight of the heavier wheel loads encountered on the various classes of city streets. In general, city streets can be grouped into four classes:

1. Heavy duty streets, comprising business streets, extension of state and county trunk line routes through cities, streets serving large manufacturing plants, freight terminals, docks, warehouses, etc. Usually such streets require a balance design cross-section of 10-6.7-10″, which is equivalent to a uniform thickness of 7.87″.

2. Arterial streets composing the principal streets not included in the class above, carrying intra-city traffic. A cross-section of 9-6-9″, equivalent to a uniform depth of 7.06″, in most cases is sufficient.

3. Feeder streets used for collecting and dispersing traffic to and from the arterial streets. Traffic on this class, both as to volume and frequency of the heavier wheel loads, is less than the previous class and an 8-5.3-8″ cross-section equivalent to a uniform thickness of 6.25″ can generally be used.

4. Residential streets carrying little traffic beyond that originating on the street or that occasioned by delivery trucks. The heaviest wheel load expected would be the relatively few trucks used in the delivery of coal or fuel oil. A cross-section of 7.5-5-7.5″, equivalent to a uniform thickness of 5.88″, should be ample for such traffic.

The actual edge thickness may vary somewhat from the figures here given, depending on the distance of slope between the center and edge thickness, the arrangement of curbs, and whether the pavement edge will be subjected to moving wheel loads. A complete discussion of this detail will be found in the 1938 report.

JOINTS

The present trend is toward a longer spacing of expansion joints and a shorter spacing of contraction joints to form slab lengths which will control cracking. Many engineers are placing expansion joints at each side of the intersection and at intervals of 120 to 140 feet between intersections. Contraction joints are spaced at intervals of from 15 to 30 feet between expansion joints. Non-extruding ex-

pansion joint fillers such as cork, wood or cane fiber, rubber, etc., are being more extensively used.

Transverse contraction joints are usually of the weakened plane type. Longitudinal hinged joints are either of the weakened plane type or metal plates. The weakened plane type is made by forming a groove in the top one-fourth to one-third of the pavement slab, which is later filled with bituminous material, or by inserting a bituminous ribbon in the top of the slab while the concrete is still plastic.

There has been a concerted effort by research engineers and material producers to develop an inexpensive sealing compound for joints which will prevent infiltration and moisture, yet will remain plastic enough to retain its waterproofing properties during winter weather without becoming so soft as to be objectionable during the hot summer months. Most of the materials which have been developed so far, which have shown promise of being satisfactory, are comparatively high in cost. Engineers of the California State Highway Commission have recently developed an oil-latex compound which is reported to be reasonable in cost and which appears to give excellent results. Undoubtedly, all producers will be able to lower their cost as the demand and production increase.

DOWEL AND TIE BARS

Dowel bars of ¾-inch diameter spaced 12 inches on centers, or some equivalent device for transmitting load from one slab end to the adjacent slab, are almost universally specified at expansion joints. Tests and research have indicated that a ¾-inch dowel about 18 inches in length is more efficient than the 24-inch length now generally used.

When expansion joints are placed at long intervals with contraction joints of the weakened plane type at relatively short intervals, dowels at the contraction joints are being omitted. In such cases the amount of contraction of each individual slab is so small it is believed that the broken aggregate particles below the groove will provide sufficient load transfer except for the corners of the slab.

The importance of providing some device for holding the dowels in exact position in the slab during concreting operations is quite generally accepted.

Shorter tie bars are being used across longitudinal hinged joints but the spacings are being reduced, the trend being towards a

maximum spacing of 2 feet 6 inches with the lengths of the bars reduced to 30 inches.

RESURFACING

Many cities have found it advantageous in resurfacing worn-out block streets, especially with W.P.A. labor, to salvage the old block for use as coarse aggregate either in cement-bound macadam or mixed concrete pavements. In these cases the blocks have been broken to a usable size either by hand or by crushing equipment. Usually 4-inch brick will produce sufficient coarse aggregate for a 4-inch slab. If a greater depth of resurfacing is desired, crushed stone or gravel are added to make up the difference.

CONSTRUCTION

Improvements of all construction machinery continue. The use of finishing machines on city street pavement work is increasing. A trend continues toward a better grading of aggregates to secure increased workability and greater economy. This is accomplished by the use of two or more sizes of coarse aggregate and in some instances by increasing the percentage of fine materials in the sands. The use of bulk cement where job conditions make it practical is gaining in popularity. It is more economical in first cost and permits the size of batches to be set for the mixer capacity without the trouble of splitting sacks.

Ready-mixed and transit-mixed concrete, where available, are being increasingly used for city street pavement construction. This method eliminates much of the large equipment at the site of the job, thus relieving traffic congestion on the streets under construction.

There is an increase in the use of built-in traffic lines. These range from a dusted-on and floated-in color to an inlaid mixture of white or colored concrete using special aggregates. Construction is simple. The annoyance and cost of periodic repainting of traffic lines are eliminated.

PRECAST CONCRETE CURBS

The past year has witnessed an increased use of precast curb and gutter. The advantages claimed are, first, less interference to traffic during construction; second, better control of quality during manufacture; third, ease of construction; fourth, usually lower cost.

In this same connection a precast white concrete facing for curbs has recently been developed. This facing is about 3½ inches in thickness and is provided with special reinforcing extending into the freshly placed concrete curb. A satisfactory installation of this nature was made last summer in the Ogden-Cicero Avenue grade separation project in Chicago.

Brick Pavements

Two recent developments in the design and construction of brick pavements are noteworthy—rolling on boards and experiments with reinforced brick pavements. Other than this, accepted practice in the design and construction of brick pavements was thoroughly covered in the report of this Committee published in the 1938 edition of the Yearbook.

Rolling on boards is a recent innovation in rolling the brick, after they have been laid and before filling. This method originated in Richmond, Virginia, and is meeting with increasing favor elsewhere. It was required on the Lincoln Tunnel pavement. It has the advantage of permitting the use of heavier rollers such as most contractors have on hand for sheet asphalt construction. The brick are uniformly embedded vertically with the minimum displacement laterally. The joint lines remain straight which is desirable from the standpoint of appearance. Following is the requirement quoted from the Richmond Specifications:

> After the brick have been laid, the lines straightened, the surface swept free of chips and the work approved by the Inspector, the brick shall be rolled with a power driven tandem roller weighing not less than five nor more than ten tons. Rolling shall be done longitudinally on boards not less than ten (10″) inches wide and twelve (12′) feet long, dressed to a uniform thickness of 13⁄16 inches laid longitudinally and in close contact. Rolling shall start at one curb of the street. The roller shall not progress more than ten (10″) inches transversely at each longitudinal roll. Sufficient boards will be required for longitudinal rolling of 24 feet. Boards which become split or broken shall be replaced.

A test section of reinforced brick pavement, 38 feet wide by 75 feet long, was installed on West Grand Avenue in Springfield, Illinois, in September, 1937. Instead of using standard paving brick in basket weave pattern, large vitrified units 3½ x 8 x 8″ were manufactured. They were laid by hand in checkerboard pattern, properly spaced, and reinforcing rods were placed in two directions in the

cement grouted joints. Transverse expansion joints will be necessary in a long project although volume change due to thermal expansion will be less than for concrete.

In August of this year (1938) the Ohio Highway Department and the National Paving Brick Association constructed another test project on U. S. Route No. 23 immediately north of the acceptance test road previously referred to. It is 20 feet wide, 200 feet long and three types of reinforcing were used—loose bars, bar mats, and welded wire fabric. The units are 3¾ x 8 x 8″. The foundation is old macadam, scarified, widened and rolled, with a thin stabilized crushed stone leveling course. If a practical success, this type of pavement will not require curbs or headers and will have all the advantages of a monolithic slab with the addition of the durability inherent in a hard burned vitrified clay product.

Developments in Design and Construction of Arterial Streets in Baltimore

A number of improvements or revisions in municipal street design and construction have been utilized by the Maryland State Roads Commission in the construction of several arterial streets in the City of Baltimore over which the Commission has jurisdiction. The following brief description of these developments is quoted from information furnished by the State Roads Commission:

Some two years ago, we developed the use of a concrete pavement finishing machine on all concrete base work and at the request of the contractors we permitted the use of a finishing machine in the laying of sheet asphalt. On the last City job constructed, a finishing machine was specified not only for the base, but for the sheet asphalt surfacing, and the results have been most surprising as the sheet asphalt surface compares very favorably in smoothness with that of our concrete roads. The only degree of roughness which might be noticed is that developed by the numerous joints in the wearing surface.

We do not have the answer quite as to the method by which the numerous joints developing from occasional shutdowns at the plant and the discontinuance of work in the evening can be eliminated. The longitudinal joints, spaced some 10 feet apart, as this was the width of the finishing machine used on this particular project, are noticeable but at this writing, which is some four months after the completion of the project, these joints have not developed into a condition which might be considered serious by the opening of the joints and permitting the surface water to reach the base.

Several methods have been suggested to eliminate such joints, one of which is the use of a burner or equipment which, by the means of

heating, will soften the adjacent surface of the asphalt, and this has been used to a certain extent on other projects, where the finishing machine was used, with some success. As to its practical application, nothing justifiable of recommendation has been developed.

Our base courses are constructed in lanes of 10 feet or greater, and dowel bars are used between the several base slabs as longitudinal connections. Dowel bars are also used between the base slabs and the combination base-and-curb.

As to the use of expansion joints and contraction joints in concrete bases and also in curb-and-gutter construction, while we use contraction joints at 30-foot intervals, normally we use no expansion joints excepting in the curb. This practice was developed after bituminous extrusion from expansion joints caused ridges across certain sections of asphalt paving. We might state, however, that by the use of the present day non-extruding material, which we are using when expansion joints are installed, there should be no further difficulty of this kind.

Joints in concrete curb and in concrete curb-and-gutter were formerly placed in 10-foot intervals. This practice has recently, however, been discarded and joints are placed opposite and contiguous with those in the base. Both contraction and expansion joints are used in both curb and combination curb-and-gutter construction.

In the construction of concrete curb and concrete curb-and-gutter, the sloping curb face has been developed and is now specified for use. The standard City curb has an exposure of not less than 7 inches and in the outlying sections, an 8-inch exposure is used. Formerly, a 6-inch exposure was used on most all street work in this locality. The slope of the curb is developed by its having a perpendicular back face, with a top 1 inch thinner than the thickness at the surface of the gutter. Ordinarily the width of the curb at the top is 7 inches, whereas it is 8 inches at the base, or at the gutter line.

On one of our last projects where the base was finished by the use of a finishing machine, a width of some 18 inches was left open inside of the proposed curb line in order to permit the construction of forms to allow the use of the finishing machine. As a result, this space had to be paved and in doing so, it was constructed as an integral part of the curb, which was referred to and constructed as a combination base and curb.

It should be stated at this point, that brick is frequently used for the paving of gutters and is placed on a bituminous mastic bed with the same type of material for a filler. Brick gutters have, in the past, been constructed to a width of 1 foot. However, the tendency is toward the construction of a wider gutter, of at least 18 inches.

As to brick pavement construction, this Department has had little or no work of this kind for the past several years, but some of the recent work of Baltimore City is worthy of mention. Considerable work of this kind has been done with P.W.A. labor. The bricks are placed at right angles to the curb line and on a bituminous mastic bed supported

by a concrete base. For a filler, a bituminous material is used. The traffic lanes on these brick pavements are clearly indicated by the use of strips of brick of a different color.

Development of Low Cost Pavement on Michigan State Trunk Lines

Second only to the automotive industry in Michigan is the tourist trade. It has become a policy of the Michigan State Highway Department to cater to this tourist traffic. One of the steps in this program has been to plan to convert the 4,500 miles of secondary gravel trunk lines, which we had in 1934, into some type of low cost dustless surface roadway system. The answer to this has been the beginning of an oil aggregate surfacing program.

There are two methods of oil aggregate surface construction: (1) road-mix, and (2) plant-mix.

Some of our Michigan counties had laid oil aggregate by the road-mix process for some time prior to 1934, so our first experiments were along that line. However, we found that the climatic conditions in Michigan made it costly and difficult to obtain consistently good results over any considerable number of months of the construction season. Also, it was found easier to obtain accurate control of mixture and application by the plant-mix method, so that type has been adopted by the state. Although the stationary plant-mix method means a larger capital outlay, we find we are well repaid by the uniform mixture obtained, the uniformity of accurate mechanical spreading on the road, and the fact that detouring of heavy tourist traffic is unnecessary.

In 1935 we constructed 18 miles of plant-mix oil aggregate road surface; 237 miles in 1936; 197 miles in 1937; 20 miles in 1938; and we plan on 232 miles during 1939. By the end of this year we will have converted 686 miles, or 15 per cent of our 4,500 miles of secondary gravel roads, into a dustless, smooth riding oil aggregate road surface 21 feet wide, with adequate shoulders, drainage, vision, etc.

Along with the state construction, many municipalities, especially the smaller ones, have joined with us by constructing curb and gutter and widening the state trunk-line system within their boundaries.

Along the same line, many of the larger cities, such as Lansing

and Ann Arbor, have constructed during the same period many miles of oil aggregate residence street pavement, using both methods heretofore mentioned.

The balance of the discussion in this paper will deal with the second or plant-mix method of oil aggregate construction, as conducted by the Michigan State Highway Department.

FOUNDATION

Our gravel roads, which in most cases were built many years ago to a 12- or 16-foot width, are rebuilt to a 21-foot width and 6-inch thickness. The gravel base thickness is increased to 8 inches on certain unstable soils and the base is shaped to proper crown. This program is now being carried on during the year previous to placing the oil aggregate surface. A careful study of soil and drainage conditions is made. Frost heave material is removed, peat swamps are excavated or displaced, and drainage is corrected. Changes in line and grade are made, consistent with the importance of the road and the funds available. In 1937 we began the use of pre-stabilized gravel for widening and thickening the gravel bases.

Small stretches of oil aggregate surface have been laid on old concrete and bituminous pavement. A two-mile stretch has also been laid on an asphalt penetration macadam base. From the results obtained, it appears that any substantial, well drained base will serve for an oil aggregate surface.

PRIME COAT

We have generally used a prime coat of 1/3 gallon per sq. yd. of MC-1B,[1] applied to the prepared gravel base several days to several weeks before laying the oil aggregate surface. When the gravel surface is highly stabilized with clay and calcium chloride admixture, it is usually necessary to reduce the amount of prime coat to 1/4 or 1/5 gallon per sq. yd. One-half of the road is usually primed at one time to permit continuous traffic.

Sometimes the rebuilt gravel base is given a surface treatment to keep the base in shape and provide a dustless surface until the oil aggregate surface is laid the following year. The prime coat is, of course, eliminated in this case. Surface treatment is applied in two operations: first, a prime coat of about 1/4 gallon MC-1B with a

[1] Unless otherwise noted, all serial designations refer to the *Standard Specifications of the Michigan State Highway Department,* Sept. 1, 1934, as amended.

chip covering, followed by about ¼ gallon of MC-5 with about 25 lbs. per sq. yd. of 50 per cent crushed ½ inch gravel chips. In some cases RC-2 is substituted for MC-5. Tars for prime and surface treatment have also been used with good results. We feel a prime coat or prior surface treatment is necessary not only to provide a moisture seal from below, but mainly to keep the gravel surface in shape during construction of the oil aggregate surface and to prevent disturbance by traffic, which must be maintained. In case the oil aggregate is not placed the next year, the above light surface treatment will very likely require an additional treatment.

THE MIXTURE

Aggregates. Our specifications provide that the aggregates may be natural sand and gravel, crushed or uncrushed; slag; crushed mine rock; crushed stone or stamp sand. Due to the prevalence of gravel in most sections of the state, and the lack of satisfactory stone, we use natural sand and gravel almost exclusively.

The following aggregate grading is specified:

	Per Cent
Passing ¾″ square screen	100
" ⅜″ " "	65-85
" 10 mesh sieve	40-50
" 40 " "	15-30
" 200 " "	0-5

The square screen is used, rather than the round, because most gravel plants are so equipped and mixing-plant square screens are more practical than the round ones.

Gravel screening plants equipped with jaw and roll crushers produce the above grading economically, usually crushing the oversized material in the pits and occasionally finding it necessary to reject excess sand. Because in some locations oversized material is not available, crushed material is not required though we feel it is beneficial. The 200-mesh 5 per cent maximum requirement is necessary to keep out of the mixture excess amounts of fine silt and clay which are difficult to dry, require more oil, and are usually hydrophilic. Clay or mud balls must comprise less than 2 per cent.

Physical requirements for the gravel aggregates are few. The modified abrasion maximum for uncrushed material is 20 per cent, and for crushed, 30 per cent. Most of our gravel aggregates fall within this requirement. Some aggregates have considerable soft

and undurable material, but, in the interest of economy, and because the oil aggregate mixture is self-healing in warm weather, they are used.

The combined sand-gravel aggregates falling within the grading range given above are stockpiled at the mixing plant and there rehandled so as to give as uniform a grading as possible. Aggregate handled directly from the gravel screen plant to the drier or mixing plant would, as a rule, fluctuate considerably within the limits of the grading specification and make it difficult to control the mixture.

Occasionally, separate sand and gravel from commercial plants are used and combined at the mixing plant. Crushed limestone and sand have also been used satisfactorily. Slag has not been tried. Crushed mine rock and stamp sand available in the upper peninsula mining sections have not been used but research work finds them satisfactory material for oil aggregate mixture.

Filler. Research work and the experience of other states led us to adope the water asphalt preferential and swell tests for filler in oil aggregate and other bituminous mixtures, especially since our aggregates are usually sand and gravel. Commercial limestone dust has been used almost exclusively. Grading specification requirements are: 100 per cent passing 30-mesh sieve and 75 per cent minimum passing 200-mesh sieve.

The Oil. For the small amount of road-mix work constructed, we used SE-3A oil, and for all plant-mixed construction SC-4A has been used. Our specification varies only slightly from the Asphalt Institute specification, but has the additional requirement of the Oliensis spot test. Since this test is a requirement for bituminous materials in our high type construction, we consider it consistent and even more important to require it for the oil aggregate bituminous material, because a thinner film and smaller quantity are used.

Perhaps the use of a slow-curing oil of even higher viscosity than SC-4, with the plant-mixed type of construction, would give a slightly thicker film covering and possibly longer life to the pavement without interfering with workability.

Proportions of the Mixture. The desirable mixture grading we strive for is within the following limits:

	Per Cent
Passing ¾″ square screen	100
" ⅜″ " "	70-90
" 10 mesh sieve	40-55

" 40	"	"	18-35
" 200	"	"	5-10

Since most of our aggregates contain between 2 and 3 per cent of 200-mesh material, it is necessary to add about 5 per cent filler.

The oil content for this mixture would average between 3 and 5 per cent by weight of the aggregate.

The amount of oil used must be sufficient to coat thoroughly all particles of the aggregate. An excess of oil tends to cause bleeding under summer traffic, with the possibility of developing a glazed, slippery surface, and instability of mixture.

Our aim has been to provide a dense, stable oil aggregate mixture which has a closed surface and contains the maximum amount of oil just short of the bleeding point. So far we have found it unnecessary to apply any seal coat or surface treatment.

THE MIXING PLANT

We require a drier to provide a continuous flow of aggregate in which moisture is reduced to under 1 per cent, a ¾ inch square screen to prevent oversize and a sand screen between No. 6 and ¼ inch to separate completely the aggregate into a two-compartment bin; accurate scales for weighing the aggregate, filler and oil; a twin pug mill mixer and an oil tank to heat the oil to a temperature of about 175° F. by steam.

Contractors have been using regular hot-mix asphalt plants of the portable or car plant type, with mixers having a capacity from ½ ton to 2 tons. Most plants are equipped with automatic feeders for the driers and dust elevators, and bins for handling bulk dust.

It has usually been found necessary to equip the hot-mix asphalt plant drier with larger fans to provide a greater volume of air, since it is sometimes difficult to reduce the moisture content of the aggregates to below 1 per cent without heating them to a temperature considerably above 250° F. Our specifications provide that the temperature of the aggregates at time of mixing shall not be over 250° F. All plants are required to be equipped with indicating pyrometers to assist in controlling temperature. In most cases contractors now have no difficulty in providing a sufficient supply of aggregates containing less than 5/10 per cent moisture and keeping the mix temperature around 200° F. Our experience has been that a temperature between 150° F. and 200° F. is best for handling and laying this mixture.

The mixing time is usually 10 seconds dry and 35 seconds wet, which provides thorough coating of the aggregate. Pug mill mixer teeth are set in "run around" order.

CONTROL OF THE MIXTURE

The control of the mixture is under the direction of our Research and Testing Division. At each mixing plant a field laboratory is set up, the building provided by the contractor and the equipment by the state. A Rotarex Extractor, necessary screens, balances, etc., are provided. The plant inspector and an assistant are men who have been trained in oil aggregate plant inspection through schools held at the State Highway Laboratory each winter in two- to four-week periods. We feel that it is essential to have trained inspectors and constant technical supervision to insure a uniformly successful mixture. A prescribed daily testing and report procedure is required of the plant inspectors. Besides making at least three extractions and numerous aggregate gradations at the plant laboratory daily, composite daily mixture samples and frequent aggregate and filler samples are forwarded to the State Highway Laboratory at Ann Arbor for checking. Daily reports are forwarded to Lansing and a continuing record is kept at the plant. Four traveling plant inspectors are necessary to make weekly contacts at each paving plant to supervise and check procedure.

Each contractor is required to provide a 15-ton platform scale at the plant, on which a state employee weighs each load of mixture. Payments are based on this weight.

LAYING THE OIL AGGREGATE MIXTURE

Upon the prepared and primed gravel base a 20-foot oil aggregate surface course is laid to a 2½ inch compacted thickness with a crown of 1½ to 2 inches. An arbitrary amount of 1,500 tons per mile is prescribed, giving an average yield of about 255 lbs. per sq. yd.

We have found that good riding quality and uniform thickness of the surface can best be obtained by the use of self-propelled mechanical spreaders, such as the Adnum and Jaeger machines. This type of spreader is specified and with it we lay the surface in half width and in two layers, thus causing little interference to traffic, and securing from the traffic considerable compacting action on each course. As a rule, the first course is laid ahead for a considerable distance (in warm weather up to 2 miles) to allow

traffic compaction, before going back to lay the second course. One side is laid 500 to 1,000 feet, then the machine is moved back to bring up the other side to prevent too much travel over the center joint. Rolling with an 8- or 10-ton tandem roller is limited to once over in a straight line; cross-rolling or turning on fresh mixture distorts and checks the surface. In cool weather the roller follows closely behind the spreader but in hot weather it may be necessary to delay rolling several hours. Shoulder material is placed against the mixture as laid and is lap-rolled with each layer. In spreading the mixture with these mechanical spreaders, inequalities in the grade are reduced in a ratio of about 1 to 4 within the length of the machine. By laying the surface in two layers good riding quality can be obtained. In case there are long depressions or distortions of the crown, hand wedging between the two layers is used to make the necessary corrections. In case there is segregation of the mixture at the joints, this is easily corrected with some mixture from which the coarse material has been screened.

Weather limitations are about the same as with hot-mix, although we have laid oil aggregate in the winter when the base was dry and free from ice. In extremely hot weather the freshly laid oil aggregate surface shows tire marks for several days but these are subsequently smoothed out by traffic. Sometimes it is necessary to roll the surface once more. Unless there is a preponderance of rubber-tired traffic to smooth out the marks, a large number of iron-tired and horse-drawn vehicles will make it necessary to apply a seal coat to the oil aggregate surface. This should be RC-1 or 2 and a layer of small crushed chips. So far we have not found it necessary to apply a seal coat. It is, of course, important to prohibit all lugged wheels from this type of surface.

When properly laid with a well designed mixture, the oil aggregate surface presents a smooth, closed texture which has sufficient non-skid quality to provide safe driving even in wet weather.

PRODUCTION

We endeavor to let oil aggregate projects in at least 10-mile lengths; some have been 25 miles. This, of course, reduces overhead and plant moving costs. Contractors with 1-ton mixing plants, working a 12-hour day in two shifts, have no difficulty in laying as much as ½ mile or 750 tons per day under favorable conditions. Sometimes mixing is carried on after dark and the mixture is

stockpiled at the plant. The next day this is loaded into trucks along with mixture fresh from the plant, making it possible to lay up to 1,000 tons in daylight hours. One mechanical spreader is capable of handling this much quite easily. On one project where the contractor provided a satisfactory electric lighting system on the spreader and roller, laying operations were carried on at night with good results.

COST

The following table gives various unit costs over the period from 1937 to date.

Year	Miles	O.A. Surface (1500 T per Mi.) Per Ton	Per Sq. Yd.	Per Mile	Total Cost Per Sq. Yd.	Per Mile
1937-38	198	$2.77 to 4.00 Avg. $3.25	Avg. $0.450	Avg. $5290	—	—
1939	232	Avg. $4.00	Avg. $0.511	Avg. $6000	$2.13	$25,000

MAINTENANCE

It has been our practice to place stockpiles of oil aggregate mixture on each project at the rate of 50 tons per mile. We find that this amount is considerably in excess of maintenance requirements. In fact, except in a few instances, maintenance so far has been limited to repairing an occasional small break. These few instances were on some of the first work where the effect of bad soil and drainage conditions was not taken sufficiently into account.

The stockpiles we have placed on the projects already constructed are not going to waste. We find our maintenance forces borrowing this handy material and putting it to numerous uses, such as patching other types of road surfaces, placing it along edges of hard surface roads where it is so difficult to hold shoulder material, and for side road approaches to paved surfaces. It serves these purposes very well.

We do not, of course, know what the life of this type of plant-mix oil aggregate surface is. From our experience and that of some Michigan cities that have been using this type, we feel that it will be seven to ten years before extensive maintenance becomes necessary. When oxidation reaches the point where excessive raveling may develop, the surface could be reworked in place with additional oil or could be surface treated.

CONCLUSION

Our experience leads us to the belief that the plant-mix, machine laid oil aggregate surface is a satisfactory low cost type for our secondary roads. The availability of aggregates, the ability to lay it without making detours necessary, the ease and low cost of maintenance, the possibility of reworking, or, by the addition of more oil, to remix dried-out material and extend the life of the surface, are all features which warrant its extensive use in our program of providing a dustless, smooth surface for our many miles of tourist-traveled gravel roads.

Sewerage and Sewage Treatment

A. P. Learned

Consulting Engineer, Kansas City, Mo.

Chairman of and reporting for the Committee on Sewerage and Sewage Disposal *

There was no outstanding development in the art of sewerage and sewage treatment during 1938. However, the extension of older sewer systems, installation of sewer systems in communities heretofore unserved, improvements in many large sewage treatment plants, and the construction of new sewage treatment plants made the year outstanding in the amount of construction and consequently outstanding in sanitation improvement. The total expenditure of $136,000,000 in 1938 for sanitary facilities is a new yearly high. A large part of the new improvements in 1938 is represented by new sewerage facilities for smaller communities.

The federal government expenditures combined with local contributions, and executed through W.P.A. and P.W.A., have added

* Committee on Sewerage and Sewage Disposal, 1939

Albert P. Learned, Chmn. .... *Kansas City, Mo.*
Carl B. Carpenter.... *Indianapolis, Ind.*
Morris M. Cohn..... *Schenectady, N. Y.*
William C. Emigh...... *Coatesville, Pa.*
James L. Ferebee...... *Milwaukee, Wis.*
John B. Hawley...... *Fort Worth, Tex.*
Clarence E. Keefer...... *Baltimore, Md.*
P. W. Maetzel .... *Columbus, O.*
William M. Piatt....... *Durham, N. C.*
Thorndike Saville ... *New York, N. Y.*
Darwin W. Townsend.. *Milwaukee, Wis.*
Abel Wolman......... *Baltimore, Md.*

materially to the extent of existing sewer systems and the installation of new systems. The combined P.W.A. programs prior to October 21, 1938, showed allocations to a total of 1,547 sewer systems with an estimated cost of $466,946,154, and to 197 combined water and sewer systems with an estimated cost of $23,805,611.

Sewer Systems

A few of the larger systems of intercepting and lateral sewers built in conjunction with sewage treatment plants were completed in 1938. Among these projects were, in New York, an extensive intercepting sewer system built at Buffalo, 5½ miles of intercepting sewers at Niagara Falls, 5½ miles of trunk and 3½ miles of lateral sewers in Onondaga County; and in excess of 60 miles of sewers at Atlanta, Georgia, 52 miles of intercepting sewers at St. Paul and Minneapolis, intercepting sewers built in conjunction with the sewage disposal plants under construction in New York City, and many minor improvements of like nature.

The 3-mile intercepting sewer tunnel at Memphis, Tennessee is nearing completion. This sewer, however, is not discharging into a treatment plant.

A storm in March, 1938, in the Los Angeles area, affecting the four counties of Los Angeles, Orange, San Bernardino, and Riverside, resulted in a severe overloading of the sewer systems, and considerable damage. The damage resulted largely, however, from the serious floods following the heavy rain. The intensity of the storm in any one hour did not exceed what might be expected during a storm with a frequency of once in about fifteen years, but because of the duration of the intensity there were runoffs exceeding any anticipated amounts. Experiences of this sort are of such infrequent occurrence, however, that it is ordinarily not economical to provide adequate sewers to handle the runoff.

A gas explosion at the Dayton, Ohio, sewage treatment plant late in 1938 did a great deal of damage. The explosion was set off, according to reports, probably by a motor, which ignited escaping sewer gas. The reports show that certain gas ignition safeguards had been removed from the gas collecting lines. This incident again brings to the fore the necessity of unceasing vigilance to provide safeguards in design and construction, and for provisions in the operating requirements that nothing be done later that will increase explosion hazards.

Sewage Treatment

The following plants are among the larger sewage treatment plants completed and placed in operation during the last year:

Atlanta, Ga.—The Intrenchment Creek plant, a 14 m.g.d. complete treatment and the Clayton works, a 42 m.g.d. primary treatment plant.
Buffalo, N. Y.—A 150 m.g.d. primary sedimentation and chlorination plant.
Cleveland, Ohio—A 123 m.g.d. activated sludge plant.
Columbus, Ohio—A 50 m.g.d. activated sludge plant.
Minneapolis and St. Paul, Minn.—A 134 m.g.d. plain sedimentation and magnetite filter plant with chemical treatment facilities provided.
Niagara Falls, N. Y.—A 50 m.g.d. partial treatment and chlorination plant.
Onondaga County, N. Y.—A 4.5 m.g.d. activated sludge plant.
Pueblo, Colo.—A 20 m.g.d. primary sedimentation plant with chemical treatment facilities provided.

There were of course many other plants of various types built, all contributing to the alleviation of stream pollution and the improvement of sanitary conditions.

The *Engineering News-Record* conducted a survey of sewage treatment facilities in the United States in 1935 and again in 1938 and part of these data, indicative of the trends in sewage disposal, are tabulated below.

Sewage Treatment in the United States

	1938	1935
Population Served by Sewage Treatment Plants	40,884,754	22,200,000
No. of Sewage Treatment Plants	4,667	3,697
No. of Plants with Treatment Ending with:		
Land Disposal	94	213
Screening	138	58
Primary Sedimentation	2,552	1,937
Oxidation	1,924	1,000
No. of Plants Using Major Processes:		
Coarse Screens	1,821	1,032
Grit Chambers	649	160
Fine Screens	96	69
Screenings Shredding	80	—
" Incineration	106	233
Grease Separation	159	—
Primary Sedimentation		
Without Coagulants	3,086	—
With "	113	—

Mechanical Sludge Removal	721	242
Septic Tanks	1,461	1,420
Imhoff "	2,062	1,687
Filtration		
Contact Beds	109	127
Trickling Filter	1,140	789
Intermittent Sand Filters	524	606
Activated Sludge		
Diffused Air	96	56
Mechanical Aeration	107	35
Secondary Sedimentation	787	456
Chemical Precipitation	114	—
Chlorination	921	655
Separate Sludge Digestion	839	374
Sludge Drying Beds		
Open	2,945	1,986
Covered	223	158
Sludge Lagoons	95	58
Mechanical Dewatering of Sludge	61	19
Incineration of Sludge	29	6
Fertilizer Production from Sludge	156	—
Gas for Heat from Sludge	491	164
Gas for Power from Sludge	51	—

It will be noted that in this short period the population served by sewage treatment plants has been practically doubled. The number of plants has increased by approximately one thousand, or over 25 per cent.

There has been a reduction in the use of land as the ultimate disposal point, as well as in the use of contact beds and intermittent sand filters as methods of disposal. These reductions are in line with trends toward methods providing higher rates of treatment and the use of less actual space for sewage treatment works.

The percentage increase has been large, although not the numerical increase, in the installations of mechanical aeration in activated-sludge methods of disposal, mechanical dewatering of sludge, and the incineration of sludge. The mechanical aeration in activated-sludge plants is seen in the smaller installations.

There has been a decided increase in the number of plants using coarse screens, grit chambers, mechanical sludge removal, separate sludge digestion, and utilization of sewage gas for heating digesting sludge. The utilization of sewage gas for power is on the increase, and in some instances a sufficient amount of power is provided to operate all mechanically driven units in the plant.

A general summary of the above data indicates that mechanical equipment is being used principally to facilitate the production of optimum biological conditions for stabilization of sewage rather than to supplant them.

This same survey records the number of separate sanitary, combined, undistributed between separate and combined, and storm sewer systems, and these data show the decided trend to separate sanitary sewer systems, which of course have proved highly desirable where sewage treatment plants are required. These data follow:

	1938	1935
Separate Sanitary Systems	4,227	3,125
Combined Systems	1,010	976
Storm Sewer Systems	98	238
Undistributed Between Sanitary and Combined Systems	1,669	1,598
Undistributed Between Sanitary Storm or Combined Systems	420	——

One of the problems that have been giving some of the larger plants some concern has been the disposal of the coarse and fine screenings and the grit collected from the grit chambers. The Sewerage Commission of the City of Milwaukee has operated a multiple hearth incinerator for burning such wastes without shutdown for the last four months and has established the fact that no other fuel need be added to the wastes to provide satisfactory incineration.

A step forward in mutual understanding and cooperation on sanitary problems was accomplished in the four-state agreement arrived at in 1938 by Delaware, New Jersey, New York, and Pennsylvania, to limit the pollution of the Delaware River. In this agreement, because of local conditions, the standards applying to the drainage basin were divided into four zones and certain minimum requirements were set up that covered floating materials, turbidity, organic substances, bacteria, acids and alkalis, and odor and taste. There are other situations in the United States where similar agreements could be beneficially worked out.

The year 1938, although not one of new major developments, has certainly been one of activity, and has resulted in improvements in methods and equipment and in understanding the possibilities and limitations of processes now current.

Water Works Practice

J. P. Schwada
City Engineer, Milwaukee, Wis.
Chairman of and Reporting for the Committee on Water Works *

Water works practice is a development, rarely characterized by revolutionary discoveries, yet pyramiding improvement upon improvement to provide adequate and efficient water service to communities of every conceivable size and nature. The layman's conception of a water works system usually begins with a vision of a large body of water and ends with a faucet in his home. Seldom does he appreciate the problems of source of supply, purification, and distribution which must be met and solved to bridge the gaps between these extremities. This "taken for granted" attitude indicates, perhaps better than any concrete evidence can, the success which has attended the efforts of the water works profession to solve these problems.

The year 1938 continued the steady development of water works facilities and practices which characterized the past number of years. Basic principles in water works practice are well established, but continuous research and experimentation produce improvements in methods and facilities. Water works problems, however, are largely individual, created by local conditions, and the extent to which they are met and solved is dependent primarily upon the will of the community and available funds.

The year 1938 witnessed the highest volume of water works construction ever reported by the *Engineering News-Record* for one year—131 million dollars. Perhaps the greatest incentive to water works construction has been the financial aid offered by the federal government in its various public works programs during the past several years. Up to December 31, 1938, there were 2,421 non-federal water works projects, estimated to cost $312,571,324, included in the

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* Committee on Water Works, 1939

J. P. Schwada, Chmn.	*Milwaukee, Wis.*	Walter A. Peirce	*Racine, Wis.*
J. R. Baylis	*Chicago, Ill.*	George N. Schoonmaker	*Toledo, Ohio*
D. L. Erickson	*Lincoln, Neb.*	Wesley W. Polk	*Evanston, Ill.*
Loran D. Gayton	*Chicago, Ill.*	Leon A. Smith	*Madison, Wis.*
L. R. Howson	*Chicago, Ill.*	William Sydow	*Miami, Fla.*
Laurence G. Lenhardt	*Detroit, Mich.*	Alfred F. Theard	*New Orleans, La.*
Frederick Ohrt	*Honolulu, Hawaii*	J. D. Webb	*Birmingham, Ala.*

several programs sponsored by the government. These were divided as follows:

	No. of Projects	Estimated Cost
Water mains	252	$ 31,095,802
Filtration plants	118	18,439,660
Reservoirs	182	27,068,990
Complete water works	1,869	235,966,872
TOTAL	2,421	$312,571,324

In addition to the above there were 196 sewer and water projects, estimated to cost $23,809,156.

During the calendar year 1938, under the Public Works Administration, there were 117 non-federal water works projects completed at an estimated cost of $47,449,096 and at the end of the year, 751 such projects estimated to cost $139,358,334 were under construction. In greater detail, these were as follows:

	COMPLETED DURING 1938		UNDER CONSTRUCTION JAN. 1, 1939	
	No. of Projects	Estimated Cost	No. of Projects	Estimated Cost
Installation of water mains, meters, and miscellaneous equipment	10	$ 908,458	61	$ 6,770,895
Construction of water works and filtration plants	6	1,951,679	53	12,249,153
Construction of dams, reservoirs and wells to supply water for culinary purposes only	5	4,454,876	50	5,843,660
Construction of complete water works and equipment	86	36,016,283	521	106,500,619
Construction of water works and sewers	10	4,117,800	66	7,994,007
TOTAL	117	$47,449,096	751	$139,358,334

There are no data available to show how much of this work would have gone forward without federal aid. However, this consideration is minor, for in the final analysis the fact that hundreds of communities have been provided with water systems, and other hundreds have improved their systems, is of paramount importance.

FLOOD DAMAGE

On September 21, 1938, eastern Long Island and sections of New England were swept by a tropical hurricane which produced floods

causing a vast destruction of life and property. Although the floods were almost identical with those which occurred in this section in 1936, it has been 123 years since a hurricane of similar proportions was experienced in this area. The occurrence of these floods so closely upon the heels of the 1936 floods upset all prior inferences as to flood frequency, and indicated a greater flood hazard in this region than was previously believed to exist.

As would be expected under such conditions, the damage to water systems was considerable. Practically all of the 41 public water supplies in Rhode Island were confronted with severe problems in maintaining service, and in Massachusetts 21 systems experienced disruptions of service. Contributing to these difficulties were power failures, broken hydrants and mains, destruction of reservoirs and standpipes, flooding of reservoirs with salt water, flooding of water works plants, decreased filter runs and increased chlorine demands.

Protection against the recurrence of such damage to water works systems is progressing in many communities in this region. The importance of auxiliary power supplies and provision for maintenance of service in regions threatened by the flood hazard is recognized by the water works field. The City of Louisville offers an outstanding example of flood protection measures to avert disaster such as experienced there during the Ohio River flood in February, 1937. A definite plan of protection of water works facilities was carried out in 1938. Vertical shaft electric pumps with motors about 10 feet above the flood crest of 1937 were installed. Additional electric supply lines, both overhead and underground, steel bulkheads and doors, and sump pumps were also installed. The window sills at one station were raised about 5 feet and new non-floating discharge mains, rigidly anchored, were constructed. In short, efforts are under way to remedy those deficiencies which resulted in the disruption of water service during the recent floods.

Progress in Water Treatment

Research toward improving the quality of water continued in 1938 with the result that much valuable information was produced and disseminated through the mediums of professional journals and meetings. This phase of water works practice is forever active in the search for means of improving coagulation, eliminating tastes and odors, and otherwise attempting to attain a high degree of perfection.

Water Purification. An interesting development in 1938 was the use of small amounts of hexametaphosphate of soda (Calgon) to prevent precipitation of calcium carbonate in softening treatments. While the use of this material appears to be confined primarily to the treatment of boiler water, it may be extended to municipal softening plants, to replace recarbonation and avoid incrustation on the sand grains and on the inside of pipes in the distribution system. The use of Calgon is included as part of the treatment in the municipal softening plant now under construction at La Grange, Illinois.

The use of acid-treated sodium silicate for improving coagulation of water has been tried on a plant scale in several filtration plants with encouraging results. It produces a much stronger coagulation when used in connection with aluminum sulfate or ferrous sulfate, and lessens the danger of coagulated matter passing the filters. Indications are that its use will increase, especially where there is difficulty in obtaining good coagulation of the water during certain periods of the year. There is also an increasing interest in the use of iron salts as a coagulant.

High pre-chlorination to eliminate all organisms which will form gas on lactose broth is becoming the practice in many filtration plants, with indications that more plants will resort to this treatment in the near future. In some plants, the excessive use of chlorine for this purpose may necessitate dechlorination subsequent to such treatment.

The better pre-treatment of the water is one of the outstanding advances in water purification in recent years. It has resulted in reducing the cost of chemicals and in relieving the loading on the filters. Flocculation of some sort is included in practically all new designs.

A method for testing the efficiency of filters has been utilized in several plants. This method passes small quantities of the filter effluent through absorbent cotton plugs until a noticeable amount of suspended material is collected on the cotton. The dried plug is ignited, and the amount of ash is a measure of the efficiency of the filter.

Water bacteriologists continued their search for a medium which would provide an index of contamination more nearly representative of actual field conditions than it is possible to obtain with the lactose broth medium. Research chemists in the Los Angeles Water

Works have obtained favorable results with the new brilliant green-crystal violet medium. Research on solid media for B. Coli determinations produced much discussion, with promising results anticipated for the near future. Progress has also been made in the removal of fluorine from water by chemical treatment. Water supplies in the southwestern part of the United States as well as elsewhere have experienced difficulties with fluorine, which is highly detrimental to tooth enamel.

An important development during the past year concerns the use of 100 cc. portions of water along with the 10 cc. portions, in order to obtain a more accurate determination of the B. Coli index. This method was adopted in Milwaukee and was discussed at considerable length by sanitary engineers in the middle west and elsewhere. It is a refinement not required by the U. S. Treasury standard, which is not particularly stringent when measured by modern purification plant results.

Filter Plant Design and Materials. Progress in filter plant design is essentially a continuation of developments which have materialized during the past few years. Surface washing of sand in the filters is being extended and all recent plants are equipped with such systems. There are several designs of surface washing systems, each more or less effective, depending largely upon the cost of the installation.

There has been little change in filtering materials, although the use of anthracite coal has been extended. The tendency is toward the use of coarser filter materials; however, some are questioning the wisdom of using such coarse substances which permit the occasional passage of a little coagulated material through the beds.

Some filters have been equipped with filter bottoms of porous materials with very good results, although it is necessary to declog the plates at intervals. Such bottoms obviate the need for perforated under-drain systems.

Taste and Odor Control. The water works profession has been very active in 1938 in research and discussion toward the elimination of undesirable tastes and odors from water. The use of activated carbon as a taste removal agent is being extended, and the threshold odor test as a measure of odor intensity in water is attracting more attention. The threshold odor test permits the evaluation of the odor intensity in units based upon the volume of odor-free water

which must be added to a sample of odor-bearing water, to reduce its odor intensity to a point where it is barely perceptible.

This test is also utilized to determine the dosage of activated carbon required and also to test the efficiency of the product itself. There is considerable debate, however, as to the degree of taste and odor removal which should be attained. This is largely a local consideration, dependent primarily upon the taste sensitivity of the community and the funds available for treatment.

Corrosion and Sterilization. The corrosive action of various waters is a problem confronting the water works profession in all sections of the country. Consequently the development of the "Langelier Index," which reveals the degree of corrosivity or encrustation of waters, is a definite step forward in the solution of this problem. The formula arrives at the correct normal carbonate content to be carried in corrosion suppression and in the prevention of encrustations due to calcium salts in softened waters, by consideration of the total solids content, nature of alkalinity and temperature of waters.

Maintaining the sterility of the water in its travels through the distribution systems has also occupied the attention of the profession. Considerable study has been given to the subject of intestinal diseases, primarily gastroenteritis, which are very often attributed to the water supply. It is of paramount importance, therefore, that in order to avoid any reflections upon the water supply the water must reach the consumer in as pure and sterile a condition as when it leaves the pumping stations. However, water works chemists and engineers can accomplish little in this study of water-borne intestinal disturbances without the aid and cooperation of health and medical authorities.

In conjunction with this subject, there has been considerable work in the matter of chlorine resistant and chlorine-ammonia resistant organisms. The possibility that such organisms may exist which are partly responsible for outbreaks of intestinal disease, especially the more obscure types, has produced research and study toward the isolation of these organisms and a means for their destruction. The future promises interesting developments in this field.

Progress toward an improved method of determining the chlorine residual in water, and also the differentiation in the residual due to chlorine and chlorine-ammonia, is being made. Experimentation with several different methods indicates the possibility of such a

development in the future, to replace the ortho-tolidine method now in use.

Protective Coatings and Methods

Much time and effort was expended in 1938 in developing coatings and methods for the protection of water pipe and tanks from corrosion. Instruments and methods of surveying soils for their corrosivity and the presence of stray currents have been improved. Linings of portland cement or bituminous materials to prevent corrosion and tuberculation on the inside of water pipe have been developed. There has also been considerable improvement in outer coatings and the technique of application and testing.

Cathodic Protection. Since it is practically impossible to apply protective outer coatings to existing water mains, cathodic protection, which has been successfully applied in the gas and oil industries, drew the attention of the water works field. This method electrifies the surrounding soil, producing a current of sufficient strength to flow from the soil to the walls of the pipe, thereby counteracting the electric currents attempting to leave the pipe and taking metal along with them. The possibilities of this method are apparent and further investigation will disclose its applicability to the water works field.

Electric Rust-Proofing of Tanks. A recent development is the protection of the interior of water tanks by an electrical method. By means of an electrode suspended in the water in the tank, an electric current is induced to flow through the water to the walls of the tanks. The electrification of the walls results in the formation of a protective film which protects the metal from the corrosive action of the water. This method has been successfully employed in several instances, but its application is limited to tanks which are continuously filled with water.

Standardization of Materials and Methods

The quality of materials and methods employed in the water works field has been improved wherever possible by standardization. However, such action is not feasible in a rapidly progressing field and consequently it must await a rather static condition. In 1937, standard specifications for gate valves were developed, to become effective May 1, 1939. In 1938, progress along this line was furthered in the laying of cast iron mains, in water works accounting, and in testing of powdered activated carbon.

Laying Cast Iron Pipe. The American Water Works Association adopted a standard specification for laying cast iron pipe to serve as a guide in making extensions to existing distribution systems or constructing new systems. It covers the entire procedure in laying, testing, and chlorinating a bell and spigot cast iron pipe water system, and the furnishing of sheeting, blocking, backing, joint materials and sterilizing agents.

"Manual of Water Works Accounting." This manual was prepared jointly by the American Water Works Association and the Municipal Finance Officers Association. It offers a very complete analysis of water works accounting to the profession, with the intention of establishing standard and efficient methods.

Powdered Activated Carbon. The increasing use of powdered activated carbon in taste and odor control has made it advisable to establish a definite standard by which the numerous brands of this product can be judged. Such tentative specifications and tests have been submitted by a committee investigating this matter. This specification has been concurred in by the American Water Works Association, but not adopted and established as a standard, because of anticipated progress in the production and methods of use of activated carbon. This tentative standard appraises powdered activated carbon on the basis of the phenol absorption test, threshold odor test, and moisture, density and fineness tests. It establishes a basis for competitive bidding and permits payment for the material on an equitable premium-penalty basis.

Specifications in Preparation. Further standardization of materials and methods employed in the water works field will be attained through the issuance of new specifications on hydrants, cast iron pipe, steel plate pipe and protective coatings, all of which are in the process of preparation.

Water Meters

Much activity and discussion in 1938 centered around the specifications and testing of cold water meters. The general attitude in the water works field indicates that the 1921 standard specifications for cold water meters, disc type, are not adequate today. Consequently, an increased rigidity in specifications as to low flow, noise, and materials entering into the manufacture of the meter has characterized the specifications adopted by Washington, Detroit, and other cities.

The American Water Works Association has recognized the timeliness of a careful reconsideration of the meter specifications, and a committee has been organized to investigate this subject.

Water Consumption Problems

Many cities in the middle west experienced a substantial reduction in water pumpage in 1938, and a corresponding decrease in revenue, because of the large amount of rainfall during the year. This was especially true in those cities in which lawn sprinkling produces an appreciable water demand.

The water demand for air conditioning continued to increase in 1938, although the alarm created by its possible demands has probably been allayed. This demand has created serious problems in some cities, and it has been necessary to resort to regulation as a means of curtailment. However, the air conditioning demand is entirely a local problem, the seriousness of which is dependent upon the development of the local water works, in relation to the consumption demands made upon it. A definite means of curtailing this demand is available through the use of water conserving devices, such as cooling towers, which have reduced water requirements by as much as 90 per cent.

The use of elevated tanks and storage as a means of meeting peak consumption demands, usually occurring in the summer months is being extended with favorable results. The City of Milwaukee has found this to be a most economical and efficient method of supplying these peak demands which occur on but a few days during the year, and then only for 3 or 4 hours. Many other cities have found that elevated tanks or ground storage at strategic locations in the system will postpone indefinitely, or for some time at least, the need for major additions to the water works.

Further Developments

Further developments in the water works field in 1938 are too numerous to mention, although many of them were undoubtedly of great import to individual water works systems.

The use of steel and reinforced concrete pipe in sizes above 36 inches is increasing. During the last year, a 54-inch reinforced concrete pipe was placed in service at Denver, under a 400-foot head, the highest head yet used on pipe of this size. The water supply system of Los Angeles placed in service, also during the past year,

the largest reinforced concrete water pipe installed to date, approximately 12 feet in diameter.

The automatic control of pumping equipment, valve operation and motor operation is increasing and has been found to be generally satisfactory. The future may develop automatic control of complete plants or major portions thereof.

Deep well turbines with submersible motors have been improved through the use of a mercury seal at the point where the motor shaft passes through the case, and by enclosing the motor in a case filled with oil of high dielectric strength. The submersible turbine eliminates the difficulties of alignment and stresses which are experienced with long vertical shafts used in the transmission of power.

There is a definite trend toward the installation of double mains in wide streets. This method has been found to be both efficient and economical while providing obvious advantages.

Provision for adequate protection of water works employees through pension plans is increasing. Such a plan was inaugurated in the State of Illinois in 1938 and also in the City of Milwaukee.

The licensing of water works operators continued to receive consideration in 1938 with indications that progress is being made.

A development of unusual interest to the water works field concerned the strike of operating engineers of the St. Louis water works on the evening of December 12. Approximately 100 engineers and apprentices were involved as a result of a jurisdictional dispute between the Operating Engineers Union and the Firemens and Oilers Union, in which the city refused to take sides. The four pumping stations were shut down for several hours until operation was resumed by non-striking employees. The city's 24-hour reserve supply in its reservoirs was adequate to supply the demand until operation was resumed.

The trend toward municipal ownership and operation of water utilities continued during 1938 at an accelerated rate. The low interest rates particularly for municipal securities are probably responsible for this activity. Utica, New York, financed the acquisition of its property through the sale of water revenue bonds at a 2.63 per cent rate. In most cases, the rate has been approximately 3 per cent.

Major Water Works Projects—1938

A few of the major water works projects begun or completed in 1938 follow:

Chicago. Construction of the first Chicago filtration plant of 400 M.G.D. capacity was started on the south side.

Cincinnati. One of the largest softening plants in the world, 200 M.G.D. capacity, was completed in 1938 at a cost of $3,300,000.

Milwaukee. The new 200 M.G.D. filtration plant was completed at a cost of approximately $5,000,000 and preparations for testing and adjusting got under way.

New York. Delaware River project—Construction of the first stage of the $273,000,000 project to furnish New York City with a water supply of 540 M.G.D. from the Delaware River was started.

Toledo. Work was started on a new $9,000,000 water supply program wherein the supply from the Maumee River will be abandoned in favor of a supply from Lake Erie.

Street Cleaning

WILLIAM A. XANTEN

Supervisor of City Refuse, Washington, D. C.

Chairman of and Reporting for the Committee on Street Cleaning *

THE PUBLICATION in 1938 of the manual entitled *Street Cleaning Practice* by the American Public Works Association is undoubtedly one of the most important contributions ever made in this field. This article will be formulated largely from the manual, as the book is obviously the foremost reference existent on street cleaning. It is to be expected that the wide distribution of the manual will have a stimulating effect, and will indirectly but ultimately lead to improvements in the general appearance of the average American city. There is much room for improvement in street cleaning operations in spite of the progress made in recent years by motorization and increased efficiency in methods and planning.

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* COMMITTEE ON STREET CLEANING, 1939

William A. Xanten, Chmn. . . . . *Washington, D. C.*
Leo P. Gallen . . . . *Philadelphia, Pa.*
William J. Galligan . . . . *Chicago, Ill.*
Harry Goodridge . . . . *Berkeley, Cal.*
H. W. Johnson . . . . *Halifax, N. S.*
G. E. Taylor . . . . *Toronto, Ont.*
N. M. Ulsch . . . . *Jacksonville, Fla.*
Wilbur H. Winship . . . . *Indianapolis, Ind.*

The underlying causes for most of the present-day untidiness of streets might be summed up as follows:

1. The drastic curtailment in appropriations for this work, in spite of an expanding task.

2. The steadily increasing quantities of refuse and paper and the difficulties which stand in the way of rigid enforcement of anti-litter ordinances. (It might be said that almost everything nowadays is wrapped twice and read only once.)

3. Present-day traffic conditions and cars parked at the curb.

Street cleaning is a work which seems to be less readily recognized than many other endeavors of the municipality, and the prevailing difficulty of securing adequate appropriations has faced the officials in charge with the anomalous condition of a static, if not stagnant, budget and an expanding task.

Naturally, the most direct result has been less street cleaning. However, this condition has also spurred officials to increase efficiency and to compare more closely their methods and costs with other cities. The widely recognized difficulty of making a sound comparison of costs gives pause to the conscientious official who may try by comparison to appraise the service rendered by his forces or who is seeking data in connection with the preparation of budgetary estimates.

Among the factors that make cost comparisons difficult of analysis are the diversity of accounting practices, the variation in amount of work done, in the character and the climate of the locality, and the differences in wage rates and leave benefits for labor. Nevertheless, comparisons will continue to be made, and therefore the Committee on Street Cleaning will give further study to this problem in the hope of arriving at some basic yardstick for street cleaning expenditures by cities.

Securing Citizen Cooperation

There are a number of important activities that have been found to be essential if any satisfactory results are to be obtained in curtailing the large quantities of litter on the streets. Perhaps the best way to instill a desire for clean streets is for the municipality itself to set an example by frequent and adequate cleaning. Eventually this should lead to cooperation by the public and thereby to the lightening of the expenditures necessary by the municipality. Also, the city refuse collection forces should provide a service of adequate fre-

quency and be required to prevent the littering of streets and alleys caused by careless handling during loading or hauling. The best cooperation in this respect exists where there is concentration of both activities in the same branch of the local government. Every employee of such an organization should be impressed with the obligation of assuming a definite interest in the maintenance of clean streets and alleys.

An indispensable part of any campaign to prevent the littering of streets is the education of the citizens to their civic responsibility. Among other ways, this may be done through the schools. Everything points to the advisability of endeavoring to reduce the amount of litter in order to control the mounting expense of removal.

The large volume of traffic and parked cars has seriously hampered the work of street cleaning and has made the task more expensive, while at the same time it has prevented the accomplishment of a first-class job. The only sensible answer to this problem, from the street cleaning angle at least, is a long-range program of parking control, with provision for off-street parking. The cities that have met this problem as it has arisen are in an enviable position. Some promise of relief is found in recent zoning law developments, requiring hotels, office buildings, apartments and the like to provide storage facilities for their occupants. A progressive step in this direction has been taken in Washington by placing a ban on parking during the winter from 2:00 to 8:00 A.M. on all important boulevards and arterial highways. Primarily this is to permit the plowing of snow to the curb during the night.

Trends in Methods and Equipment

Among the larger cities practically all the outstanding street cleaning units today are directed by engineers. In many smaller cities practical superintendents are capably handling both the field operations and the technical work. The planning of street cleaning activities, the selection and maintenance of equipment, and the management of labor forces usually require technical engineering supervision and for this reason street cleaning is normally allocated to a public works agency.

Practically all cities have abandoned the contract method in favor of conducting the work by municipal forces.

Curb-to-curb cleaning under present conditions is less rigidly

adhered to, and the removal of litter from sidewalks and parked strips is being accepted more or less as a necessary function.

With increasing traffic and longer hauls to disposal points being faced in most cities, motorization of the street cleaning service has been rapidly taking place. Most cities today are completely motorized. Small patrol sweepers have recently been developed which are similar to the larger machines, but which are designed essentially to handle gutter cleaning and for greater maneuverability. Gallonage capacity of flushers has increased, although this tendency will no doubt be limited by traffic conditions and width of streets so as not to constitute a traffic hazard or retard cleaning operations by reduced maneuverability. Some of the better managed municipalities have installed preventive maintenance procedure, that is, the regularly scheduled servicing and inspection of each piece of equipment by properly qualified mechanics and the immediate correction of any weakness disclosed. This is an item of importance in the economical operation of this or any other work where equipment plays such a large part, and it is to be expected that this system will be a standardized municipal practice in future years.

The development of snow removal operations and the growth of public demand for municipal removal service has been gradual but very steady, arising principally since the advent of the automobile. In most cities the work is confined to the sanding of icy streets, rather widespread plowing, and the physical removal of snow from congested areas. Snow removal should be a well-planned operation, and no longer can a haphazard assignment of this work to the normal street cleaning forces be expected to cope with the demands of the public.

There is a growing sentiment among street cleaning officials that there is merit in providing uniforms for the employees, a practice rather prevalent in predepression days, although today relatively few cities are financially able to present a uniformed force to the public eye. Of more importance, perhaps, is the need for control of and extreme care in the selection of personnel. In view of the fact that street cleaning is largely a task for manual labor, the foundation of an efficient job must rest with the physical well-being, energy, and good conduct of the individual laborer.

The maintenance of public space in a spotless and litter-free condition at all times is the goal of every street cleaning official. It is felt

by many that a unique characteristic of this work of street cleaning is that there is a relatively small difference between a sufficient and an insufficient operating fund. The expenditure of thousands of dollars annually for street cleaning is a necessity in every city in the country. The allotment, if insufficient, results in a shabby and ill-kempt appearance most of the time, whereas only a slight increase in the appropriation, permitting a somewhat greater frequency of cleaning, may be the difference between "always dirty" and "always clean." Under these circumstances supplemental allotments to swing this balance in favor of *"always clean"* should be a matter of good common sense and economy.

Developments in Refuse Collection and Disposal

Stuart M. Weaver

Executive Assistant to Director of Public Works and Sup't. of Water Bureau, Montclair, N. J.

Chairman of and Reporting for the Committee on Refuse Collection and Disposal *

The developments in refuse collection and disposal during the year are characterized more by the pronounced acceptance of the trends of recent years than by important innovations in methods and practices. There is more and more indication that this important function is receiving greater consideration and study and that it is being accepted more generally as an engineering matter that requires careful planning and skilled supervision. The increased interest of public officials in improving general sanitary and health conditions in municipalities, apparent during the last few years, has given rise to developments in a rather large number of cities.

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* Committee on Refuse Collection and Disposal, 1939

Stuart M. Weaver, Chmn. .... *Montclair, N. J.*
H. J. Cates .... *Atlanta, Ga.*
David W. Godat ...... *New Orleans, La.*
John V. Lewis .... *Rochester, N. Y.*
Carl Schneider ...... *New Orleans, La.*
William B. Shafer .... *Pittsburgh, Pa.*
Ralph C. Taylor .... *Cincinnati, O.*
Jean L. Vincenz .... *Fresno, Calif.*

Refuse Collection

During the recent depression it became a rather common practice to waive the rigid enforcement of some of the sanitary ordinances. Many communities have not yet fully recovered from this lack of enforcement. A large number of cities are still unable to require the householders to provide suitable containers for refuse, to insist on adequate separation, or to limit the activities of scavenger pickers, making it impossible to obtain the degree of sanitation and cleanliness desired. Nevertheless, numerous other cities have made considerable improvement in this direction through public education and law enforcement measures. In general, it is becoming increasingly apparent that the public officers in charge of refuse collection and disposal activities want to do a more complete and efficient job of collecting refuse. It is equally apparent that citizens and householders are still clamoring for better and more complete service, particularly in those communities where incomplete collection is now made.

It is becoming quite generally recognized by public sanitation officials that it is not wise to refuse to collect certain classes of refuse or to limit the amount of refuse that will be accepted at each collection, particularly in residential areas. The task of keeping city streets and alleys in a clean and sanitary condition is almost an impossible one unless there is a complete collection of refuse materials. It is believed by some officials that such complete collection will ultimately save money for their cities by reducing the cost of cleaning streets and vacant lots and by eliminating the necessity for spring clean-up collections. Some cities that formerly limited the quantity of refuse that would be accepted at each call have found that very little additional expense is involved in loading and disposing of all material that is set out, and that the communities are thereby much cleaner and the householders better satisfied. Some places that still have such restrictions in their ordinances are waiving them in many cases.

Increased attention continues to be given to the management and administration of refuse collection operations. Scientific work planning particularly has received a big impetus during the year. Numerous cities have rearranged collection routes and have adjusted the methods of operation as the result of rather complete study of field reports or general surveys of conditions. It has been known for some

time that insufficient data are available in most municipalities to make the right kind of planning possible. City officials, in general, have not been willing to expend the sums that would be necessary to secure detailed information as to the number of refuse producers, their location, the number of persons at each point of collection, and the approximate quantity of material at each point. Fortunately it has been possible to secure W.P.A. assistance in this work, and several cities have completed the collection and tabulation of such detailed data. The city of Detroit is now undertaking an unusually complete investigation of this character.

Several cities for a number of years have systematically improved the general working conditions of refuse collection and disposal workers. There is some evidence that most cities are now following this lead and are taking every opportunity to provide for the comfort and safety of their employees. It is probable that such improvements are due as much to the better character of management of the refuse service as to the desire to avert labor troubles.

Private collection of refuse, particularly in residential areas, has never been regarded as completely satisfactory by refuse collection officials. Although the control of such collection by municipalities has become increasingly rigid, it has been found that it is impossible in most cases to depend solely on private collectors to pick up the refuse from an assigned area. St. Louis abandoned private collection routes during the year and now sells garbage at a central point to the hog farmers who wish to purchase it, the selling price being based on the current price of corn. Richmond, Virginia, permits private collectors to pick up garbage in certain residential areas but in every case the regular city collectors must cover these areas to insure complete and adequate service to the householder. Numerous other cities sell or give garbage to hog farmers at incinerators or at transfer stations. Most cities have not yet reached the point where they are willing to take a positive stand and refuse to permit hog farmers to collect or receive garbage within the municipalities. It is probable that the municipalities are abetting the continuance of insanitary conditions and nuisances by this practice, but they are also assisting numerous small farmers to be self-supporting where otherwise they might be dependent on relief donations for existence. Many cities permit private collectors individually to buy garbage from hotels and restaurants and to transport it to hog farms outside the municipal limits. There is no indication that this practice will be

curtailed except through the licensing of such private collectors and the insistence on sanitary collection and hauling practices and on satisfactory equipment.

Although there are many cities in this country that still collect or dispose of their refuse by contract, the gradual trend toward municipal operations continues. During the year Baltimore, Maryland, Montclair, New Jersey, and New Bedford, Massachusetts, abandoned contracts and started municipal collection. Detroit abandoned contract disposal and now handles the entire operation with municipal forces.

There is still no agreement among refuse collection officials as to what constitutes good collection equipment. Despite continued improvements in the design of refuse collection bodies and notwithstanding a greater variety of styles and sizes available, many cities are not able to find the body designs which meet their needs or their desires. Numerous cities have made designs for special collection equipment including both open and enclosed bodies, and are either manufacturing the equipment in their own shops or are contracting for its fabrication according to their own specifications. It may be that the local conditions in different cities are so varied that no standardization of such equipment is practicable. There is little question, however, that equipment costs are considerably higher than they would be if some general agreement as to body sizes and style could be reached and the equipment manufactured in quantity. It is generally accepted now that the dump bodies manufactured for general construction work are unsuitable for refuse collection because the body capacity of these vehicles is relatively too small for the light weight refuse and the loading heights are too great. There appears to be some movement in the larger cities away from the 1½-ton chassis toward the 2½- or 3-ton sizes. The smaller size trucks having three to six cubic yards water level capacity seem to predominate in the smaller communities. The motorization of collection equipment continues at a rapid pace.

Refuse Disposal

The opinion persists among sanitary engineers and refuse disposal officials that anything short of complete destruction of organic wastes is unsatisfactory and insanitary. The trend of recent years toward the adoption of modern incinerators is now as strong as ever. The lack of sufficient funds and the necessity for reducing

disposal expenditures have prompted the continued use of less desirable methods such as sanitary fill, burial, open dumps, and hog feeding. Many cities are still dumping all refuse on open dumps and, for the most part, are experiencing strong public reaction against this practice. It is probably simply a question of time before such municipalities will have to adopt more modern methods.

A very large number of cities still dispose of their garbage by feeding it to hogs. The disclosures last year by the United States Public Health Service to the effect that trichinosis is far more prevalent in garbage-fed hogs than in grain-fed animals have not had any apparent effect on the continuance of this disposal method. The feeding of garbage to hogs is practiced by a few cities and some large contractors, but by far the greatest use of this method is by the thousands of small farmers near the urban centers who raise a small number of hogs. There is naturally a great inducement for city officials to sell the garbage to farmers rather than to pay for its disposal, or else to allow the farmers to collect the garbage in certain areas and thus eliminate the costs of municipal collection. Nevertheless, the United States Public Health Service again this year emphasizes the widespread occurrence of trichinosis in human beings and indicates that the consumption of pork from garbage-fed hogs is largely responsible. It is an interesting question as to just how far a city can go in contributing to the prevalence of unsatisfactory public health conditions under the guise of an economy program. It may require several years to produce a marked change, but it is believed that this disposal method will gradually be replaced by more sanitary and less harmful means.

The attention of refuse disposal officials has been directed toward the sanitary fill method of disposal, mainly by the controversy that has arisen due to the adoption of this method in New York City in preference to the more expensive operation of their new incinerators. It is apparent that far too little is known about the extent of the decomposition of organic wastes under various conditions. It is probable, however, that under suitable conditions satisfactory disposal can be made when the material is placed in layers of proper depth and when the amount of cover is correctly proportioned. It is generally accepted that refuse can be disposed of by this method without nuisance, but that when the operation consists simply of burial, the question is immediately raised as to the wisdom of using

land for a purpose that may destroy or impair it for future development.

On the other hand, it is known that the open dumping of rubbish and even garbage makes satisfactory fills and has been the means of reclaiming much worthless land. The unsatisfactory aspect of placing garbage in open dumps, however, has made this method very unpopular. The dissemination of odors, the breeding of rats and other vermin, and the occurrence of frequent and dangerous fires have been responsible for a definite swing toward more sanitary means of garbage disposal. Furthermore, many cities have a very limited amount of available dumping area within reasonable hauling distance, and in such cases, it may be very prodigal to use it for dumping all classes of refuse. The obvious course is to study the local conditions carefully with a view to the development of a long-range plan for the economical and sanitary disposal of wastes over a period of years. It may be that some other form of disposal or salvage may be much more desirable, and may even be more economical.

The increased use of incineration as a means of garbage and combustible refuse disposal continues to be the most pronounced trend in the refuse disposal field. The number of incinerators in operation has increased each year in spite of the rigid economy programs adopted in many municipalities. The public appears to be gradually accepting the fact that the cheaper, insanitary disposal methods may not be in the best interest of the health of the community. During the year, new incinerators were built in Detroit, Mich., (four plants), Manchester, N. H., Roanoke, Va., Rochester, N. Y., (rubbish only), Schenectady, N. Y., New Orleans, La., and numerous other places. Plans have been completed for other plants which will be constructed in the near future. Included in this class are Minneapolis, Minn., Pittsburgh, Pa., Cedar Rapids, Ia., and New Rochelle, N. Y. Cincinnati is enlarging both the easterly and westerly plants from 100- to 200-ton capacity and is installing crane equipment for charging the furnaces. New Orleans completed its fifth plant during the year and has prepared plans for enlarging one of the older plants.

Although the courts have generally held that modern incinerators can be operated without creating nuisances, the people living near incinerator sites do not readily accept this view. Two of Detroit's new plants are now idle because of injunctions obtained by citizens.

Many cities have indicated an interest in disposing of garbage by grinding, although there has been but little development in this field during the year. Lansing, Michigan, has completed its grinding plant at the new sewage treatment works, but it has not yet been placed in operation.

Shelby County, Tennessee, placed in operation last year a new reduction plant for the disposal of dead animals of Memphis and other communities of the county. It is located at the modern penal farm of the county and is operated by convict labor. The first six months of operation of this plant give every evidence that this venture will save the taxpayers substantial sums annually.

Traffic Progress in 1938

BURTON W. MARSH

American Automobile Association, Washington, D. C.

Chairman of and Reporting for the Committee on Traffic Control *

IN 1938 for the second time in modern motor vehicle history, the number of motor vehicle fatalities was lower than for the preceding year. The decrease was nearly 20 per cent. The only other decrease since 1920 was in the depression year 1932, when the toll was about 13 per cent lower than in 1931.

Undoubtedly part of the 1938 reduction was related to adverse economic conditions. But a very substantial proportion of the improved record must be credited to the growing momentum of a rather rapidly improving attack on the toll.

The past few years, and especially 1938, have witnessed what appears to be the beginning of an effective attack on our serious traffic problems. This attack is characterized by several significant changes. The public is becoming aroused, and is beginning to insist on im-

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* COMMITTEE ON TRAFFIC CONTROL, 1939

Burton W. Marsh, Chmn. . . . . *Washington, D. C.*
Lewis V. Bullis. . . . . . *Washington, D. C.*
John H. Hunter II. . . . . *Philadelphia, Pa.*
Edwin F. Koester. . . . . *Wilmington, Del.*
Frank J. McDevitt. . . . . . . *St. Louis, Mo.*
Theodore M. Matson. . . . . *New Haven, Conn.*
D. Grant Mickle. . . . . . *Ann Arbor, Mich.*
Robert A. Mitchell. . . . . *Philadelphia, Pa.*
A. J. Naquin. . . . . *New Orleans, La.*

provements. Scientific methods, being carried out by increasing numbers of trained technicians, are replacing haphazard, emotional activities. Safety weeks and temporary "drives" are being replaced by continuing programs of proved value. Much more money and many more competent men are being devoted to the task, under increasingly improving direction. Researches are producing new facts and these are being utilized to make activities more productive.

Emphasis is increasingly being placed on main needs, such as better accident records and more effective uses thereof, stricter enforcement, driver education and training, higher standards for driver licensing, pedestrian protection, better general educational activities, remedies for the high night accident toll, personnel training, extension of high grade traffic engineering, improved highway design better fitted to modern traffic needs, and further important research—as for example on the sound use of speed.

National organizations, in increasing numbers, are undertaking practical programs for traffic improvement, and most governmental agencies are accepting their responsibilities and carrying out activities with a new vigor and effectiveness. The former attitude of apathy and defeat is rapidly disappearing as increasing evidences are produced that large-scale improvements are possible.

In many ways, 1938 was a banner year. It may well go down in history as the year when the tide turned and the numerical toll of traffic accidents began permanently to recede. Likewise, through the state highway planning surveys and other advances, 1938 was an important milestone in the development of new and improved highway facilities which will reduce delays and inconveniences and produce more orderly traffic.

Technical skill is at last being given its opportunity to improve highway traffic conditions, and it is demonstrating its right to leadership.

Continuation of Improvement Activities

In reporting on progress in 1938, it was deemed unnecessary to repeat material presented in your Committee's report of last year. But significant progress on such activities should be presented.

A. State Highway Planning Surveys

The U. S. Bureau of Public Roads is continuing its active cooperation with state highway departments in these basic surveys. Forty-

six states have such surveys in operation at the present time. Preliminary reports have been published in several states including Oregon, Ohio, Michigan, Vermont, and Maryland. Data are already being used in a number of states, as for example in the improvement of locations having worst sight distances, and in determining which bridges most need reconstruction because of inadequate head room. About $4,000,000 of W.P.A. money has been and is being used by 23 of these states.

B. Federal Assistance to Other Traffic Surveys

The number of committees which have submitted acceptable applications for F.E.R.A., C.W.A. and W.P.A. work relief funds for highway traffic and transportation surveys has increased from 265 to 294. One hundred sixty-two of these committees received approval of W.P.A. funds amounting to over $14,000,000 from July 1935 to January 1939. Nearly $9,000,000 of this amount was for surveys in 123 cities.

During 1938, nearly $5,000,000 of W.P.A. funds were approved. Surveys covering 25 cities, 2 counties and 3 states were started during the year, and 19 cities, 6 counties and 3 states reported completion of W.P.A. surveys. Among the latter cities are Louisville, Youngstown, New Orleans, Portsmouth, (Va.), Trenton, and Kansas City, (Mo.)

Significant developments in 1938 were: (a) making available the services of a full-time traffic consultant for field assistance to communities; (b) a decision to develop and encourage simpler types of studies (an experienced traffic engineer was employed to prepare new simplified procedures, and the first such has been published: *Selecting Safest Routes for Elementary School Children*); (c) publication by W.P.A. of digests of subject matter of more than 200 such traffic and transportation surveys as a part of the *Index of Research Projects,* Volume I.

C. National Traffic Safety Contests

These contests for cities and states, sponsored annually by the National Safety Council, included more cities and states in 1938.

D. Automotive Safety Foundation Program

This Foundation, financed by voluntary contributions from more than 150 companies in the automotive field, intensified its program in 1938. The Foundation does not engage in any direct traffic safety activities. Instead, in 1938 it made grants of money to fifteen quali-

fied national organizations for specific activities initated and administered by them, to make effective the standard Highway Safety Program for States (see p. 128 of last year's Yearbook). A large number of the non-governmental activities described herein are aided by such A.S.F. grants.

E. C.I.T. Safety Foundation Program

The Foundation continued its program of annual awards to persons in several lines of endeavor whose traffic safety activities were judged to be the best. Increased attention was given to the Seminars of Safety for newspapermen, two of which were held in 1938—one at New York and one at Indianapolis.

F. Kemper Foundation

This Foundation continued its provision of financial fellowships for police taking work at Northwestern University Traffic Institute.

G. Alfred P. Sloan Traffic Awards

During 1938 these were applied for fellowship training in police work and traffic engineering.

H. Motion Picture Awards

These awards were continued in 1938. "Man at the Wheel," produced by the March of Time, was adjudged the winner in the entertainment film class, and "The Chance to Lose," produced by the Chrysler Corporation, was the winner in the institutional film class.

Activities of A.P.W.A. Committee on Traffic Control

Unfortunately, a very great number of engineers have not yet seen the need of traffic engineering, or at least they have not taken an active part in advancing that essential activity. The A.P.W.A. Committee on Traffic Control is therefore continuing its project for the promotion of traffic engineering.

Every city of 50,000 population or more should have a full-time traffic engineer and every state should have an adequate traffic engineering staff. In addition, certain counties should have traffic engineering organizations. Furthermore, a suitable plan should be developed to provide traffic engineering for communities with less than 50,000 population. Yet only about 50 cities and only about half the states have full-time traffic engineering.

The activities of the Committee during 1938 have been three-fold:

1. *Educational.* The Committee has been seeking to inform engineers, newspaper representatives and others in a position to foster the inauguration of traffic engineering.

2. *Assignment of Traffic Engineering Responsibilities.* Many communities do not consider themselves in a position to employ a full-time traffic engineer. The Committee has, therefore, been promoting the idea of designating a selected member of the engineering staff as the person to whom all engineering matters in traffic will be referred. It is believed that if this is done, many such engineers will see the opportunity thus presented, study the subject and acquire skill in traffic engineering.

3. *Vocational.* The Committee has been promoting the institution of traffic engineering instruction by colleges and universities and encouraging enrollment in such courses by interested engineers.

Significant New Organizational Activities

1. *National Institute for Traffic Safety Training.* A two-week intensive training program for each of half a dozen types of special work in the traffic field was provided at the University of Michigan in August, 1938. Here for the first time, engineers, teachers, police officers, statisticians, drivers' license examiners and safety organizers received special vocational training in the mornings and attended general conferences and demonstrations on traffic problems in the afternoons.

The demand for such specialized training was well shown by the 140 persons who registered in this Institute. All sections of the country were represented, as well as Canada and New Zealand. This Institute was sponsored by five national organizations and the University of Michigan. The Institute is to be repeated August 14 to 26, 1939, at Ann Arbor, Michigan.

2. *New York University Safety Center.* This was set up in July, 1938, with funds provided by the National Conservation Bureau, which represents the stock casualty insurance companies. It provides courses in safety education, conducts studies in the field of safety, prepares educational materials and furnishes some field service. For the school year 1938-39, twenty-eight fellowships and scholarships were provided for teachers.

3. *Eno Foundation for Highway Traffic Control.* The first building of its sort is the magnificent headquarters of the Eno Foundation, the cornerstone of which was laid in the fall of 1938 at Sauga-

tuck, Connecticut. This beautiful and spacious structure contains a sizeable lecture hall, museum, library, specially built vaults for valuable papers, drafting room and executive offices. It will be used for promotion of orderliness and safety in highway traffic.

4. *Esso Safety Foundation.* Financed by the Standard Oil Company of New Jersey, this Foundation has provided funds for studies of driver characteristics, driver license examinations and similar matters by the American Association of Motor Vehicle Administrators, working in collaboration with the Institute of Human Relations at Yale University. During 1938 major work was done on studies for improvements in driver license examinations, reports on which are soon to be published.

Researches, Investigations and Studies

A. Highway Planning Surveys

Reference has already been made to the continuation of the highway planning surveys. By sound analysis and interpretation of the many important facts which are being obtained, these surveys can provide invaluable guidance for the development of a highway system which, within the limits of available finances, will best provide for modern traffic needs. However, it is extremely important that the needed analyses be carried out and that the survey data be kept reasonably up to date. Apparently some states are much more progressive than others in this respect.

B. U. S. Bureau of Public Roads and American Association of State Highway Officials

The Special Committee on Administrative Design Policies of the American Association of State Highway Officials which is cooperating with the U. S. Bureau of Public Roads is responsible for some very important researches relating to the use of highways. The Bureau has published a report on "Transition Curves for Highways" (Government Printing Office, 60¢) which provides tables and data which simplify the introduction of "spirals" or easement curves at the beginning and end of highway curves.

Several important researches have been started on the basic question of traffic behavior, as for example an important study on overtaking and passing practices. The Bureau of Public Roads has designed mechanisms employing electrical road strips and recording devices for studying the manner in which vehicles use the road

surface. Further refinements of these devices give great promise in providing much more accurate information on such important matters as the lateral positions of vehicles on a lane, speeds of various vehicles on hills of different steepness, and effects of darkness on certain driving practices. Also being carried on are important researches on intersection design and on hill-climbing ability of trucks.

1. *Superhighway Investigation.* In accordance with Section 13 of the Congressional Act of June, 1938, Public Law No. 584, 75th Congress, the Bureau of Public Roads made an exceedingly important investigation of proposals for a superhighway system consisting of not over three east-west, and three north-south superhighways. The state highway planning surveys provided much essential information. The report shortly to be made to Congress will, it is believed, prove one of the most significant ever made relating to our highway system and modern traffic needs.

2. *Anti-Skid Resurfacing.* Increasing attention is being given to the development of surfaces which will provide a high tractive resistance. In St. Louis over 135 miles of streets have been resurfaced with a material providing considerably higher anti-skid qualities than the sheet asphalt surfaces which were largely covered. The material is a hot bituminous mixture including dolomite chats. It is put down over asphalt in about a three-fourths' inch mat at approximately 250° F. It is then rolled with a moist roll and compacted to about three-eighths of an inch. It can be used immediately after rolling. On the approach to a number of intersections, where pads of this material have been installed over sheet asphalt, accident records show substantial reductions.

C. Highway Research Board

Year by year the Board serves as a stimulator, clearing house and publication agency for an ever-growing body of basic research on highway and traffic matters. During 1938, a special study relating to highway speeds was carried on by the Board in cooperation with the National Safety Council. Steps were also taken toward the conduct of a study of highway lighting and related matters dealing with night traffic conditions.

D. Yale Bureau for Street Traffic Research

In 1938 this Bureau shifted its affiliation from Harvard to Yale University. It carried on research on overtaking and passing. In cooperation with the Michigan State Highway Department the

Bureau made an extensive study of two types of traffic deflectors or roadway dividers. These devices are being considered especially for locations on existing two- or three-lane highways where traffic should never cross the center of the highway.

E. Vehicle Headlighting

The automotive industry has been cooperating with lamp manufacturers and motor vehicle administrators in studies relating to the improvement of vehicle headlighting. This work gives much promise of producing important improvements in the future.

F. American Association of Motor Vehicle Administrators

As mentioned above, this organization in cooperation with the Esso Safety Foundation has been making important driver studies particularly from the point of view of bettering driver licensing standards.

G. Bureau of Motor Carriers, Interstate Commerce Commission

This Bureau is carrying on work designed to improve the safety and efficiency of operation of commercial vehicles and buses. One important study relates to the number of hours of continuous operation, and a study of driver fatigue by the Bureau of Public Health Service of the Department of the Treasury, in behalf of the Commission, is in progress.

H. American Automobile Association

During 1938, the Association brought nearly to completion a two-year study, the most extensive ever made, of the pedestrian traffic situation. Since pedestrian fatalities constitute from two-thirds to even 100 per cent of all motor vehicle deaths in cities and from one-quarter to one-third of fatalities on the open highway, it is exceedingly important that attention be focused on methods of protecting, educating and aiding pedestrians. (Figure 1 shows the relative pedestrian hazard according to age, based on pedestrian fatalities in Washington, D.C.) To this end the Association announced national contests involving awards and national recognition for municipalities, states and schools doing the best work in this field.

1. *Parking and Terminal Facilities.* The A.A.A. has also advanced a study, under the direction of an outstanding national committee, on parking and terminal facilities. Improved regulations of curb parking can increase turnover and improve parking and loading conditions in cities. Nevertheless, it is becoming increasingly evident

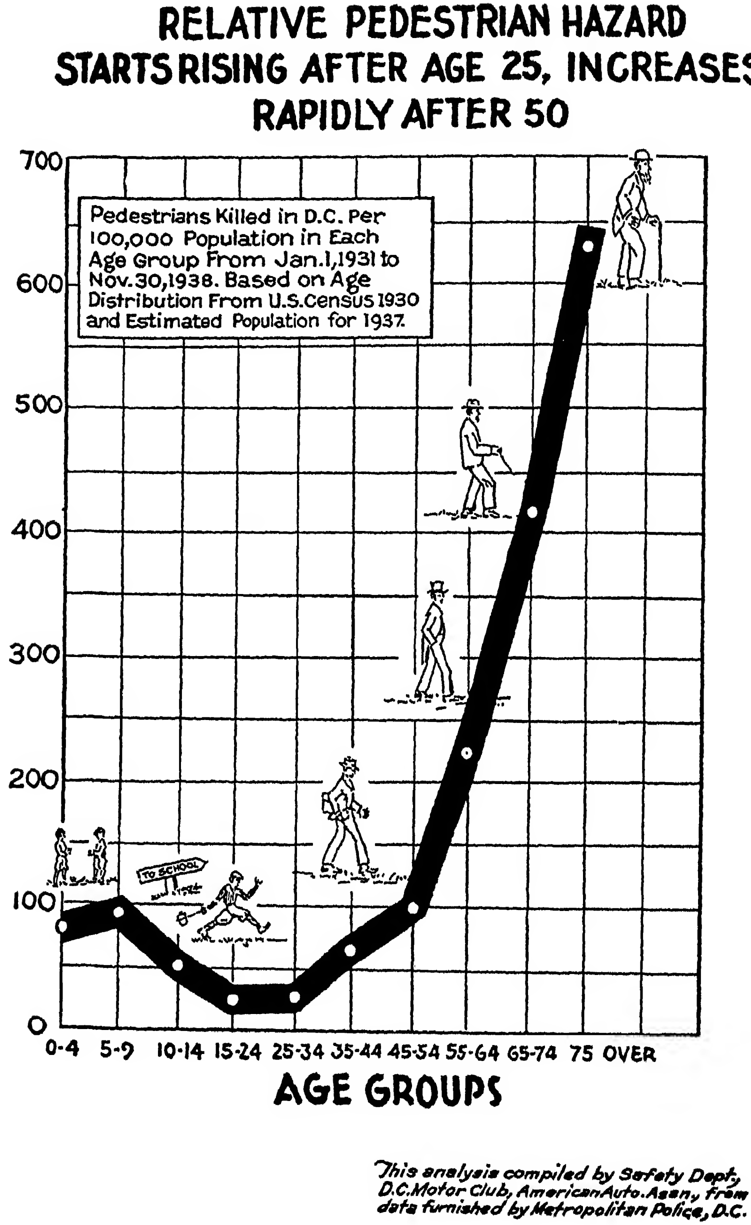
RELATIVE PEDESTRIAN HAZARD
STARTS RISING AFTER AGE 25, INCREASES
RAPIDLY AFTER 50
Pedestrians Killed in D.C. Per 100,000 Population in Each Age Group From Jan.1,1931 to Nov.30,1938. Based on Age Distribution From U.S.Census 1930 and Estimated Population for 1937.
TO SCHOOL
700
600
500
400
300
200
100
0
0-4 5-9 10-14 15-24 25-34 35-44 45-54 55-64 65-74 75 OVER
AGE GROUPS
This analysis compiled by Safety Dept, D.C.Motor Club, American Auto. Assn, from data furnished by Metropolitan Police, D.C.

FIGURE I

that off-street terminal facilities are necessary if cities are to make adequate provision for the potentially large number of persons who desire to store motor vehicles temporarily in central business districts. Already some communities are providing for increased development of off-street terminal facilities through building codes and zoning ordinances. In a few cities, parking space *must* be provided in connection with the development of certain types of new structures.

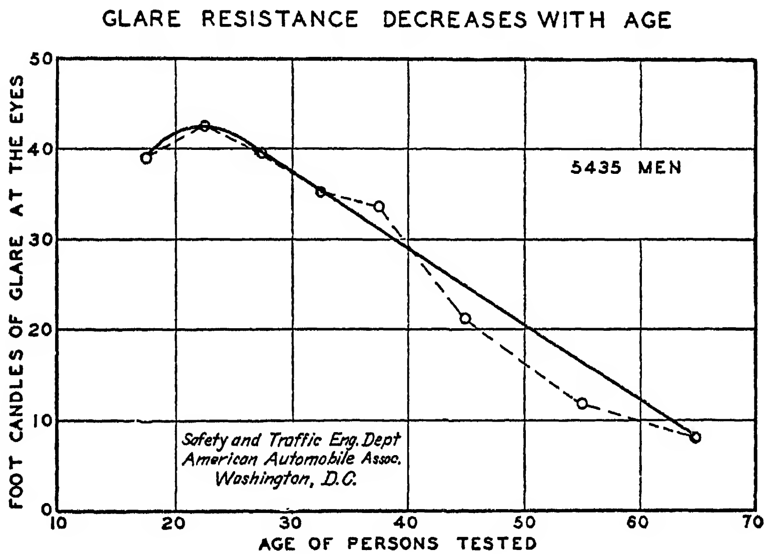

FIGURE 2

Outstanding among problems relating to the off-street storage of automobiles is the economic feasibility of the various plans used or proposed for use. For example, what type of off-street facility will provide adequate return on investment? Is municipal operation desirable? If so, how can the city best provide convenient parking facilities at minimum cost?

2. *Driver Researches.* The American Automobile Association also conducted analyses of extensive data on driver characteristics. One very significant finding is that ability to see against glaring light decreases sharply with advancing age especially after 40. An average person aged 60 can see against only about one-fourth as much glaring light as can a person aged 25. (See Fig. 2.) Ability to see when

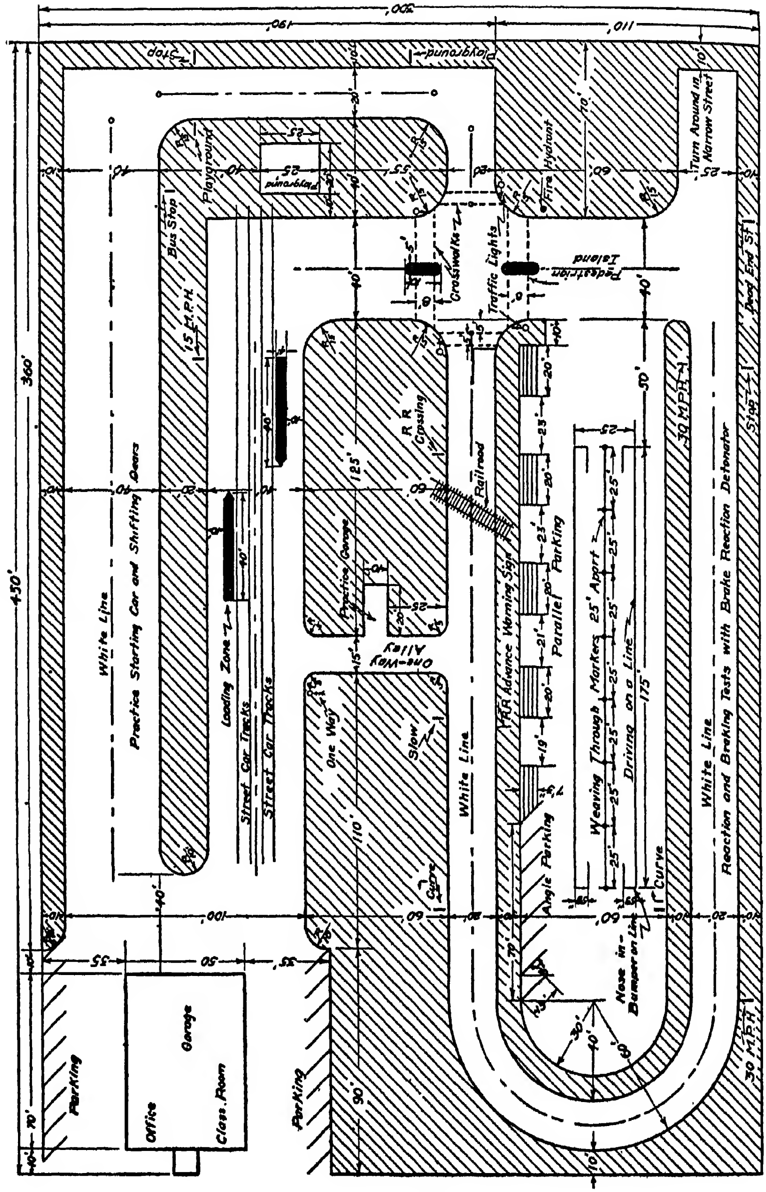

Figure 3. In some localities special off-street facilities are arranged so that driver training can be given in a more effective manner. The above layout was prepared to serve as a guide to colleges and schools desiring to construct such off-street practice and testing areas. It embodies most of the conditions which the average motorist encounters. In addition, there are certain special features used in giving thorough training and in testing driving skill of learners. Detailed plans are available from the American Automobile Association.

confronted with glaring light also varies considerably among persons of any age. Shouldn't tests for this important seeing ability be given all drivers?

The Association also studied various methods of making effective road tests of driving ability, for use in its national driver training program. New methods and devices were developed, including a novel device for recording jerky acceleration and deceleration. A model plan for an off-street driver training field was made available. (See Fig. 3.)

I. New Analysis of Seeing Ability

A group of specialists interested in problems of seeing while driving met twice during 1938 at the research laboratories of the General Electric Company at Nela Park, Ohio. It was agreed that the critical seeing job at the wheel is not that of distinguishing well illuminated small objects which appear in sharp contrast to their background, this being the seeing ability tested by the usual visual acuity test of reading small black letters on a white chart. The problem is to see dimly lighted objects which present relatively little difference in brightness from their background: for example, a man in dark clothing against a dark pavement at night. Studies were therefore instituted of this kind of seeing ability. Indications to date are that persons with the same visual acuity (as tested by Snellen chart) may vary greatly in this other seeing ability. Further research is being carried on.

J. National Safety Council

The Council has a number of active committees working on significant studies, including night accident hazards, speed and accidents, tests for intoxication, pedestrian control and protection, and bicycling.

K. Northwestern University Traffic Institute

During 1938 a report based on a three-year committee and staff study indicated a close causal relationship between accidents and the use of alcohol.

L. Enforcement

A number of interested groups have combined to form the National Committee on Traffic Law Enforcement, which has started extensive studies designed to bring about better enforcement standards and numerous other improvements in traffic law enforcement.

Engineering Developments

1. *Roadside Markers.* Following investigations at the General Motors Proving Ground, U. S. Route 16 from Lansing to Detroit was chosen by the Highway Commissioner of Michigan for the first extensive trial installation of a new type of roadside marker designed to indicate at night important characteristics of the road ahead. These markers are made of lucite and embody a Stimson design which is highly efficient in returning light from the headlights. Reflectors were mounted vertically in units of three on posts approximately three feet high. On each post are two sets of reflectors, one facing in each direction. The posts were placed eight feet from the edge of the pavement at 100-foot intervals on both sides of the highway. Under normal conditions these reflectors can be seen much further ahead than the driver needs to know the road course.

Side roads can be spotted, and hillcrests or sharp curves are easily noted by the termination of the visible line of reflectors. During the six-month period following installation, records indicate that night accidents declined from 91 to 36, as compared with a similar six-month period of the year before. The number of fatalities dropped from 10 to 4 in the same period.

These improvements were better than the day-time improvement on that highway and were better than night improvements on other highways in Michigan. (Michigan showed a substantial reduction of accidents in 1938.) Reports from drivers indicate that they are in favor of these reflectors as an aid to night driving. Additional installations have been made in Ohio, Maryland, and elsewhere.

2. *Revision of Manual on Uniform Traffic Control Devices.* The national Committee on Uniform Traffic Control Devices reviewed proposed modifications in this Manual and adopted a number of changes including: better designation of "no passing" zones; improved day and night effectiveness of route markers, destination signs and major traffic signs; reflectorizing sign symbols and main message instead of border outlines of warning signs; and improved provisions for pedestrian protection through traffic control signals.

At the request of the Committee, the U. S. Bureau of Public Roads agreed to carry out a number of investigations for further improvement of traffic control devices and their use, including: better design of arrows; more effective standards for lettering, including the relation of size to customary vehicle speeds; and further considera-

tion of a table of braking distances especially in relation to the higher speeds.

Recent observations of members of this Committee indicate that much more attention is being given to providing traffic signs of adequate size and so designed as to be effective at night.

3. *Institute of Traffic Engineers' Decision to Broaden Scope of Activities.* At its annual meeting the Board of Direction of the Institute decided to take steps to broaden the scope of activities of the Institute as, for example, in making it possible to assist municipalities, counties and states desiring to install effective traffic engineering organizations. A program for financing these more extensive activities is now being advanced.

Personnel Training

One of the most outstanding advances in 1938 has been the greatly increased emphasis on specialized training for persons active in various parts of the highway traffic field. Mention has already been made of the National Institute for Traffic Safety Training and the Center for Safety Education at New York University.

1. *A.A.A. Teacher Training Program.* Two staff educators in the American Automobile Association continued a program of providing high school and college teachers with specialized instruction on how to present courses in traffic, safety and driving. To date more than 1700 teachers throughout the country have received such specialized instruction through the activities of the A.A.A. The staff educators of the Association have conducted extensive training programs at 10 colleges and universities during the year and have promoted and assisted in 36 summer sessions. The A.A.A. conducted two courses at the National Institute at the University of Michigan.

2. *Yale Bureau for Street Traffic Research.* This Bureau, formerly at Harvard, continued emphasis on its fellowship program in traffic engineering. In addition, it conducted a traffic engineering course in the National Institute for Traffic Safety Training and carried out a special course in Nebraska.

3. *Northwestern University Traffic Institute.* This Institute and the Safety Division of the International Association of Chiefs of Police have provided several types of training courses for police, both state and municipal, in addition to the one-year fellowships mentioned heretofore. The I.A.C.P. has also cooperated with various universities and colleges in the country in organizing and conducting

regional training programs. Such courses were held in 1938 at the University of Alabama, Pennsylvania State College and the National Institute for Traffic Safety Training.

4. *Rutgers University, Bureau of Public Safety.* At Rutgers University the Bureau of Public Safety greatly enlarged its activities in 1938. Rutgers pioneered in making its Safety Bureau an inherent part of the program of a State University. The head of the Bureau ranks as an assistant professor and the University grants certificates to those who meet requirements of the curriculum. Courses of various types and length were conducted for police, engineers and in traffic education.

5. *Pennsylvania State College Creates Public Safety Institute.* Announcement of this step was made in 1938. The Institute provides training and other services to various workers in the traffic field as well as in other fields.

6. *National Safety Council.* The Council was responsible for courses on traffic accident reports and records, driver license examinations, safety organization and public education, and handling drivers with bad records at the National Institute for Traffic Safety Training. It also carried on training work in various states and cities.

Legislation and Motor Vehicle Administration

Revision of Uniform Vehicle Code. A national committee considered proposals for improving the Uniform Vehicle Code and adopted a number of them. Changes included such important matters as strengthening of driver licensing provisions, increasing requirements for accident reportings, modifying speed regulations, improving pedestrian protection through signals, strengthening regulations relating to intoxicating liquor, and additional regulation of bicycling.

Improvements in Driver Licensing. In the past few years a considerable number of states have enacted driver licensing laws, so that today only four states do not require driver's licenses for passenger car drivers. Licensing laws and procedures are gradually being strengthened, but in general are still very weak.

Adequate Right-of-Ways for Highways. Increasing emphasis is being given to the need for securing adequate right-of-ways for highway purposes. At the 1938 Annual Meeting of the American Association of State Highway Officials, this subject was given much attention. Bills have been drafted and are now before a number of

state legislatures extending the authority of highway departments in obtaining of right-of-ways.

It is increasingly realized that in order to have main highways which will retain design capacity, efficiency and safety, the public must accept new concepts as to highway right-of-ways and the relationship of the highway to abutting properties. The freeway principle described in last year's report is receiving increased attention and favor. Furthermore, it is being realized that metropolitan areas are the locations where there is the greatest need for modern highways embodying most if not all of the principles of the freeway.

Further legislative changes may be necessary to bring about the types of development warranted in these areas. For example, special ways must be found and made legal for acquiring the necessary property.

Roadside Protection. The A.A.A. Committee on Roadside Development and Control developed a model bill providing for keeping all structures (including billboards) at least 50 feet away from the highway, except wayside stands for sale of produce raised or goods manufactured on the premises (which stands must be at least 25 feet from the right-of-way line), and for other control measures within a 1000-foot protected area on both sides of the highway.

Matters Warranting Further Emphasis

Among the many needs in the traffic field, the following seem to warrant special emphasis in the months ahead.

1. Improvement of accident reporting, analysis and interpretation. Accident report forms need improvement; reporting is incomplete and often inaccurate on certain points. Many jurisdictions are not making even fairly effective uses of their accident records, and relatively few are doing what might be termed a first-class job of analysis, interpretation and use.

2. Improvement in driver licensing standards and procedures.

3. Development of effective methods for educating the general public. Much progress has been made with children in grade schools. Good progress is now being made with the high school group.

4. The pedestrian in traffic. A.A.A. studies indicate that this major problem has received scant attention in most places to date.

5. Night accidents. The increased proportion of accidents which occur at night, and the seriousness of night accidents, indicate the need for special attention to this subject.

6. Parking and terminal facilities. The need for further attention to this subject has already been mentioned.

7. Elderly drivers and pedestrians. For the first time we are coming into an era in which a large proportion of licensed drivers will be elderly persons. Driver research made by the American Automobile Association and others indicates clearly that elderly persons need especial study and consideration. The A.A.A. driver study shows that with advancing years come a number of impairments which can affect the quality of a person's driving particularly if he does not realize the changes and make appropriate adjustments. A.A.A. studies of the pedestrian indicate that older persons are predominant in the pedestrian fatality toll. Here, then, is a problem, growing more serious every year, which must be given greatly increased attention.

8. Acceleration of the extension of traffic engineering.

9. Methods of securing adequate right-of-ways for highways.

Street Lighting

SANFORD C. LOVETT

Superintendent of Lights, Bureau of Engineering, Pittsburgh, Pa.

Chairman of and Reporting for the Committee on Public Lighting *

FOR SEVERAL years developmental work on street lighting was greatly curtailed and the development of new fixtures and studies in street lighting improvements was at a standstill. However, within the last three years there has been added to the tools of the street lighting engineer the new and radically improved type of luminaire such as has been used in Detroit with such unusually gratifying results. With this type of luminaire it is possible to increase greatly the effective street lighting, particularly at those angles

* COMMITTEE ON PUBLIC LIGHTING, 1939

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W. T. Blackwell .... *Newark, N. J.*
Ellsworth Francisco .... *Newark, N. J.*
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L. A. S. Wood .... *Cleveland, O.*

removed from a point directly under the lamp, if directional equipment is employed. These modern types of luminaires are designed to confine the light, for all practical purposes, within the lower hemisphere. In addition to the many large cities which have received considerable publicity from the manufacturers' copy, many smaller communities have also taken advantage of this improvement in fixture design and have materially improved visibility and safety conditions on the streets and roads generally.

Some of the most interesting studies associated with street lighting have been the studies conducted by several of the active road building engineering committees in cooperation with the manufacturers of street lighting equipment. These studies have been directed toward finding means for improving road surface reflection characteristics. The experiments have included the use of coloring material on the road surface together with surface indentations and glinting substances, in the hope of finding a material which will not add too prohibitively to the cost of the finished road and will tend to improve general lighting and safety, particularly when the pavement is wet. Some of the articles bearing on this subject of improved surface treatment, while too technical for incorporation in this review, are extremely interesting. Two of them dealing with road surface reflectants will be found in the *Crushed Stone Journal* for September and October, 1938, and in the *Engineering News-Record* for October 31, 1937. There is also being prepared for the Asphalt Paving Technologists a very comprehensive article which will be released by the Asphalt Institute by the time this report is published. All of these articles show very clearly the necessity for the closest cooperation between the street design engineer and the street lighting engineer.

Value of Directional Equipment

A review of the improvements in street lighting design which have been described in the technical and non-technical press indicates that the greatest improvement in street visibility has been accomplished by the substitution of pendant types of luminaires for the ornamental upright type of luminaire, frequently without any increase in wattage and at a tremendous increase in safety both to the pedestrian and the automobile operator. It will be found that the use of directional equipment is of tremendous assistance in providing better street lighting, and frequently that existing equipment

provided with directional control equipment will accomplish results seemingly beyond belief. In lighting as applied particularly to residential and light traffic streets, it is found that the location of the luminaries is generally fixed, because of the poles on which is mounted the street lighting equipment. Almost invariably the use of directional equipment applied to this type of installation will tremendously reduce the low intensity areas between the lights, and result in a satisfactory intensity for traffic and safety requirements.

Because of the limited appropriations made for street lighting during the last several years, many of our streets are not lighted to an intensity admitting of proper safety to the traveling public, and offer a severe handicap to the police and fire departments in their normal functioning. While the matter of traffic accidents should be one of the most important considerations of the street lighting engineer, the necessity for street lighting equipment which will be helpful to the police and fire departments, and will act as a silent policeman on duty throughout the period in which the streets are artificially lighted, must not be overlooked. The modern type of glassware used on the pendant fixtures has a light absorption of approximately one-half that of the opalescent type of symmetrical glassware, and where directional equipment is employed with the modern glassware the improvement will be very marked.

There seems to be a woeful lack of uniformity in accident records both locally and nationally, and it is the suggestion of this Committee that steps be taken to encourage the use of the street lighting schedule instead of the vague figure, "dusk," used in their compilation. If the actual time of the accident is indicated in the report, and reference is made to the local street lighting schedule employed, the record will indicate very clearly whether there should be a correction in the time for applying the street lighting arrangements. The term "dusk" might legitimately be used in rural and highway accidents where no street lighting is employed. A large percentage of the traffic in a considerable period of the year uses the streets to go to and from places of employment during the period of "dusk," and as the traffic congestion is most acute in that period of the day it is our opinion that much more accurate deductions could be drawn were the street lighting schedules applicable in the various communities used to show the time of accidents. These schedules have been corrected for local conditions.

It has been suggested that your Committee on Street Lighting undertake a thorough study of street lighting throughout the United States with the idea of preparing model forms of contract rate structure and discussing street lighting equipment including design and planning, standards of maintenance, and such allied subjects as seem pertinent. If it is considered that this study will accomplish results of benefit to the members, your Committee will attempt the compilation of this data.

Flood Control, Irrigation, and Drainage

ABEL WOLMAN

Chairman, Water Resources Committee, National Resources Committee

EXPANSION of federal authority construction activity in the field of flood control, changes in national irrigation policy, and a continuation of rehabilitation work in drainage enterprises marked the year 1938.

FLOOD CONTROL

Federal responsibility in the field of flood control was broadened measurably by the Flood Control Act of 1938.[1] Extensive surveys were undertaken by the Departments of War and Agriculture, and a large-scale construction program was continued and expanded.

Major Policy Changes

The War Department was given complete jurisdiction over dam and reservoir projects, and channel-improvement or channel rectification projects, local participation ceasing to be a federal requirement.

In addition to authorizing comprehensive plans for flood control in a number of major drainage basins, the Congress authorized appropriations of $375,000,000 to carry out the improvements recommended in the Act over a five-year period ending June 30, 1944, and $10,000,000 to be divided equally between the War Department and

[1] Public Law No. 761, 75th Congress, approved June 20, 1938.

the Department of Agriculture for examinations and surveys. An additional sum of $1,500,000 was authorized to be appropriated to the Federal Power Commission, for examinations and surveys relating to possible uses of flood-control reservoirs for power generation.

A major modification of the Act of 1936 embodied in the Act of 1938 involved the repeal—for projects other than local-protection projects—of that provision which required local groups to (a) assure provision, without cost to the United States, of necessary lands, easements, and right-of-ways, (b) hold the United States free from damage due to construction, and (c) maintain and operate the structures without cost to the United States. States, political subdivisions, or other responsible local agencies shall, hereafter, be reimbursed by sums equivalent to such actual expenditures as may be deemed reasonable by the Secretary of War and the Chief of Engineers and as may be made by these agencies in acquiring lands, easements, and right-of-ways for storage or channel improvement projects for flood control.

Of special importance was the granting of authority to the Chief of Engineers to determine if the cost of an authorized project requiring levees or flood walls may be reduced by evacuation of a portion or the whole of the area, in which event he may eliminate such construction and make use of the allotted sum for evacuation and rehabilitation purposes.

Preliminary investigations and surveys of 105 localities were authorized by the Flood Control Act of 1938, making a total of 459 such projects authorized to date. Sixty-three construction projects for flood control were adopted for the various river basins of the United States.

The Secretary of War and the Chief of Engineers possess the right to select and modify the projects authorized by the Act. The Secretary of Agriculture also was authorized to make preliminary examinations and surveys for run-off, water-flow retardation, and soil erosion prevention on the watersheds where the projects are located.

The Secretary of Agriculture was empowered further to make examinations and surveys on projects already designated to be undertaken by the Secretary of War, for the purpose of correlating the War Department program with the watershed improvement program initiated by the Department of Agriculture.

Outstanding Study and Construction Projects

The War Department expenditures for construction of flood-control facilities and repairs to existing facilities during the fiscal year 1938 were $51,226,865.

Basin study projects for which allotments were made in excess of $300,000 included the Red River, Yazoo River and tributaries, Arkansas River and tributaries, Missouri River, and the Wabash River.

A general survey of the Mississippi River from Head of Passes, Louisiana, to the headwaters of Lake Itasca, Minnesota, a distance of 2,434 miles, was completed and maps of the river published.

Merrimack River Basin. The works in this area covered by the comprehensive plan for flood control and other incidental benefits are located on the Merrimack River and its tributaries in New Hampshire and Massachusetts. The Flood Control Act of 1936 authorized construction of a system of reservoirs in the Merrimack Basin for the reduction of flood heights. Field surveys, foundation investigations and preliminary designs for five sites from which the comprehensive reservoir system will be selected were made. Plans and specifications for the first reservoir (Franklin Falls) of the comprehensive system were nearly completed, but no construction work was initiated on this system.

Connecticut River Basin. Activities during the year included the raising of levees at Hartford, Conn., and at Springfield and West Springfield, Mass., and the construction of levees at Springfield, Mass.

Plans and specifications were completed for three dams: namely, Union Village, Vt., Knightville, Mass., and Surry Mountain, N. H. Construction of these reservoirs likewise was delayed in part by failure to ratify the interstate compact and by lack of agreement upon reimbursement of state and local groups for prospective loss of tax base in the reservoir areas.

Ohio River Basin. A coordinated reservoir system for the protection of Pittsburgh and the Upper Ohio Valley was in progress during the year. The ultimate system consists of the construction of 14 reservoirs on tributaries of the Ohio River, of which 10 have been authorized by Congress.

All preliminary investigation and survey work, including the clearing at the dam sites and topographical surveys, was completed

on the Tionesta and Crooked Creek reservoirs in Pennsylvania. Plans and specifications were approved, contracts for the dams were awarded, and the actual construction was in progress, including the excavation of the tunnel intakes and the general program of the work.

Preliminary surveys and investigations for the Mahoning Creek, Red Bank, Conemaugh, Loyalhanna and French Creek reservoirs were in progress or completed during the fiscal year. Nearly all of the preliminary work incidental to the actual design of the reservoir system was completed.

At the close of the fiscal year Tygart Dam in West Virginia was 99 per cent complete, at a total cost of $17,739,189.

The Muskingum Valley reservoir system, involving the construction of 14 reservoirs in the Muskingum watershed for flood control and water conservation, having a combined storage capacity of 1,126,400 acre-feet for flood control and 412,800 acre-feet for water conservation, was 96 per cent complete at the end of the fiscal year. On June 1, 1938, these structures were turned over to the Muskingum Watershed Conservancy District for continued maintenance and operation which is to be carried on in conformity with the requirements of the Chief of Engineers. The total cost of the project to date is $26,016,080.

Red River. The Denison reservoir, located on the Texas-Oklahoma state line five miles northwest of Denison, Texas, was authorized by the Flood Control Act of 1938. Although no money has been directly appropriated for the project, certain preliminary surveys and investigations have been made, and three alternate proposals have been submitted by the district engineer.

Yazoo Basin. A project for the construction of Sardis Dam, an earth dam and reservoir for flood control on the Little Tallahatchie River, was authorized by the Flood Control Act of 1936. During the year, work on the construction camp, field surveys, construction of floating plant, transmission line and sub-station were completed, with a net expenditure incurred to June 30, 1938 amounting to $3,713,215. The estimated construction cost of this project, including damages and land acquisition, is $10,400,000.

Arkansas River Basin. The major reservoirs under consideration for the development of a flood-control program of the Arkansas River were the Caddoa reservoir, 18 miles north of Lamar, Colo.; the Fort Supply reservoir, 12 miles west of Woodward, Okla.; the

Great Salt Plains reservoir, 12 miles east of Cherokee, Okla.; and the Hulah reservoir, near Bartlesville, Okla. All were authorized by the Flood Control Act of 1936 to provide for flood control and water conservation in Colorado, Kansas and Oklahoma. Surveys, foundation explorations and engineering studies were made in connection with these sites, and construction camps and roads were built for the Fort Supply and Great Salt Plains reservoirs. The total cost of these four reservoirs is estimated at $27,199,000.

The Conchas Dam and reservoir project, which is to provide flood control and which may also be used for irrigation and water supply purposes, was 59 per cent completed, with a total present expenditure of $6,327,230.

Los Angeles County. This project is located along the Los Angeles and San Gabriel Rivers and Ballona Creek and tributaries. The flood of March, 1938, affecting the coastal basins of Southern California, caused severe damage to the partially completed channel improvement works on the Los Angeles River. Restoration of this damaged work was nearly completed in 1938, with modified design at critical places, between Chevy Chase Drive and Daytona Avenue, a distance of approximately five miles. Restoration of damaged work above Niagara Street was postponed until Hansen dam is nearly complete.

Improvements of the Verdugo Wash, Alhambra Wash and Haines Canyon were completed. Compton and Ballona Creeks were also substantially completed except for capping of jetties at the outlet and minor side drainage features. All of the units so far completed have been accepted by the District for maintenance and operation. The Los Angeles County Flood Control District was required to contribute $3,500,000 toward the cost of this work. In addition to the fulfillment of this requirement, the District made a voluntary contribution of $738,000 toward the construction of bridges and of the Eaton dam.

The Federal Emergency Administration of Public Works had a few non-federal projects for flood control under way during the past year involving a total expenditure of $3,618,816.

In some instances the Federal Emergency Administration of Public Works made a grant of 45 per cent and a loan of 55 per cent to furnish the total cost of the project. In other instances, the Public Works Administration furnished the grant only and the applicant furnished funds equivalent to 55 per cent of the cost of the project

by the sale of bonds or by receiving a loan from some source other than the federal government.

Typical of the non-federal flood control projects completed in the last year by the Administration was that for the City of Council Bluffs, Iowa. The Administration made a grant of $743,400 and the city furnished $908,600 for the improvement of approximately seven and one-half miles of the Indian Creek flood channel, nearly all of which was within the city limits.

Consent was given by the Congress to the Minnesota-South Dakota-North Dakota Compact[2] relating to the utilization, the control of the floods, and the prevention of pollution of the waters of the Red River of the North, and streams tributary thereto.

Irrigation

Although few major changes occurred during the past year affecting federal irrigation policy, the jurisdiction of federal irrigational activities was modified in one direction and expanded in another.

Major Policy Changes

The Bureau of Reclamation, charged with the principal conduct of federal reclamation developments, witnessed a modification of the repayment program of which it is the administrator, while increases in the reclamation fund and the initiation of another large-scale federal reclamation project enlarged the Bureau's program.

The second Deficiency Appropriation Act of 1938 took a step toward a new irrigation policy in relation to relief needs by designating $5,000,000 of the funds made available by the Emergency Relief Appropriation Act for construction of water conservation projects in the Great Plains and arid and semi-arid areas of the United States. These funds were to be allocated by the President to federal departments or other agencies and to be returned to the United States by the beneficiaries of the projects in not more than forty annual payments. If supplemented by relief funds to cover non-reimbursable costs to the extent that the relief load permitted, they would have made possible a substantial use of relief funds to bring about permanent rehabilitation of some areas.

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[2] Public Law No. 456.

However, the funds carried the limitations that not more than $50,000 might be expended on any one project, and that work relief requirements must apply to the use of all funds. Until such time as these limitations may be waived, the policy will remain inoperative.

Authorization also was given the Secretary of the Interior to construct a federal reclamation project for the Arch Hurley Conservancy District in New Mexico under conditions designed to curb land speculation. It was stipulated that all owners would be required to sell land they possessed in excess of 160 irrigable acres at or below a price set by the Secretary of the Interior. In the event that the land is sold at a price above the value approved by the Secretary, one-half of the excess will revert back to the United States and be applied on the construction charge installments of the owners of the land in the inverse order of the due dates.

The repayment commission, created by the act of August 21, 1937,[8] has made studies and recommendations which it is felt will be effective in furnishing a basis for legislative enactments providing a more flexible and equitable method of reimbursing the Reclamation Fund for construction expenditures. The repayment commission, having investigated all the federal reclamation projects in operation at the present time, granted relief on payments to ten projects or units of projects during the fiscal year. The postponed payments amounted to about 10 per cent of the total payments due.

The Reclamation Fund was increased approximately $30,000,000 by the Interior Department Appropriation Act of 1939, which provided that the difference between 52½ per cent of the money collected between February 25, 1920, and June 30, 1938, on royalties from the naval petroleum reserves and the total of all sums advanced to the Reclamation Fund, and not reimbursed by transfer, should be deposited in the Reclamation Fund. It also provided that in future the repayments from all irrigation projects other than Boulder Dam, and including projects financed with emergency funds and appropriations from the general treasury, should be covered into the Reclamation Fund. Revenues from power on these projects will go into the Reclamation Fund until the cost allocated to power is repaid, after which time the net revenue will be covered into the general treasury.

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[8] Public Law No. 351, 75th Congress.

Interstate Negotiations

Possibly the most significant undertaking during the past year was the Rio Grande Joint Investigation, culminating in a compact between New Mexico, Texas, and Colorado, which has been signed by the states concerned but requires ratification by the state legislatures and the Congress of the United States.

This compact brings to a close a quarter of a century of controversy and legal suits over the apportionment of the waters of the Rio Grande and stands as an example of the accomplishments of cooperative action between federal, state, and local organizations.

Congress granted consent to the states of Idaho and Wyoming to negotiate and enter into a compact not later than January 1, 1940, providing for an equitable division and apportionment between them of the water supply of the Snake River and tributaries.

Status of Projects

The year 1938 marked the beginning of actual large-scale construction on the Central Valley project. This project is designed to alleviate the critical water shortage existing in three important agricultural areas of the state by utilizing the flow from the Sacramento to San Joaquin Rivers and by retaining the waters resulting from the spring thaw to be used during the summer months for irrigation of the broad valley between the coastal range and the Sierra Nevada Mountains.

The Bureau of Reclamation at the end of the calendar year 1938 had the Columbia Basin Project 38 per cent complete. This project is intended for the ultimate development of 2,700,000 horsepower and the irrigation of 1,200,000 acres, which will make possible about 40,000 successful farmsteads in the vast dry basin which it will irrigate. The total cost of the project when complete will be $394,500,000.

Another major development was the Colorado-Big Thompson Project, located in Summit, Grand, and Larimer Counties, Colorado. The project is for irrigation and power development and consists in the development of five reservoirs with a storage capacity of 891,592 acre-feet and the utilization of two lakes by the construction of 11 dams in addition to two diversion dams, designed to divert and store excess waters of the Colorado River supplied by melting snow

during May, June, and early July. One of the power plants, and two of the reservoirs and the two lakes are on the Colorado Basin side of the Continental Divide. From Grand Lake the water will flow 13.1 miles by gravity through a tunnel under the Continental Divide and then fall more than 2,800 feet through the five proposed power plants that will eventually be constructed along the Big Thompson Canyon. The water will then be stored in the three reservoirs to be constructed on the eastern slopes of the divide and be used as supplemental supply for irrigating 615,000 acres of private land already under an irrigation system which is at present provided with adequate water.

The expenditure by the Bureau of Reclamation for the fiscal year 1938 was $47,659,000, the major portion of this sum having been allotted for irrigation development, and the remainder for flood control and power generation in connection with the irrigation reservoirs.

The Reconstruction Finance Corporation continued its activities with respect to the refinancing of irrigation projects which have become bankrupt or have been reduced to a financial condition making it impossible to maintain the project or make the necessary repairs. One of the large irrigation projects refinanced by the Reconstruction Finance Corporation in the past year was the Danta-Carbona Irrigation District of San Joaquin County, California, in which case the refunding loan amounted to $702,500.

Drainage

During the past year drainage work has been continued by the Civilian Conservation Corps, by the Works Progress Administration, and by financial aid given through Reconstruction Finance Corporation loans.

From the initiation of the C.C.C. program in the summer of 1935 until December 31, 1938, approximately 9,000 miles of ditches were cleared and 58,350,000 cubic yards of dirt excavated. All work was under the technical supervision of the Division of Drainage of the Department of Agriculture. Approximately 345 miles of public tile drains were relaid and more than 3,500 structures, such as bridges, tile bulkheads, and ditch bulkheads were built. Contributions received from cooperating drainage districts in the form of materials, equipment, and personnel, amounted to approximately $3,250,000.

During the calendar year 1938 the Division of Drainage supervised the operation of 39 C.C.C. camps engaged in the rehabilitation of drainage enterprises. The distribution of the camps was:

Delaware	2	Illinois	5	Kentucky	2
Maryland	3	Indiana	6	Louisiana	5
Ohio	7	Iowa	5	Missouri	4

Under regulations issued by the Director of the Corps, the work of these camps was limited strictly to the repair and rehabilitation of existing drainage works under the control of drainage enterprises organized under state laws. No new drainage improvements were constructed, and no work was done on private ditches. Active cooperation of drainage districts was required in handling the work.

Every effort was made to have the work of the camps serve as a demonstration of proper maintenance of drainage improvements. Ditches were rehabilitated with sloping banks and with waste banks so leveled that the land may be cultivated to the edge of the ditch. Outlets of lateral ditches and tile drains were properly protected with suitable structures with the view of reducing future maintenance costs.

The Bureau of Agricultural Engineering entered into a cooperative agreement with the Mississippi State Planning Commission during August to make an investigation to determine the physical condition of the drainage improvements in some 300 drainage districts of that state, and to determine the amount of work necessary to put the drainage improvements in satisfactory operating condition. The Mississippi State Legislature appropriated $20,000 for the work, and the State Planning Commission secured approval of a W.P.A. project, appropriating $60,000 for the work.

The Reconstruction Finance Corporation during the fiscal year 1938 made total disbursements of $50,000 to drainage and levee districts for construction and deferred maintenance.

Field Engineering

Walter Starkweather
Division Civil Engineer, U. S. Coast Guard, Seattle, Wash.
Chairman of and Reporting for the Committee on Field Engineering *

The subjects concerning field engineering which have been receiving the most attention in the technical press during the past year are coordinate systems, local control surveys, and photogrammetry. This is apparent from the articles and books listed in the bibliography at the end of this report. Other subjects in the bibliography indicate the wide variety of minor trends for the year. There are also fields where progress is being made each year, such as national and state mapping and levels. Other subjects of particular interest during this year were coordinate conversion, geodetic control, land courts, and preliminary surveys for P.W.A. projects. Improvements in surveying instruments, equipment, and methods have also had a share of attention.

Coordinate Systems

Plane coordinates based upon state plane coordinate systems are being computed for all triangulation stations of the U. S. Coast and Geodetic Survey as fast as facilities permit. To date over 28,000 of their triangulation stations have been computed on the respective state plane coordinate system. Several states have made legal the use of these plane coordinates in property description as supplemental to the customary method of describing the location of a tract of land.

Control Surveys

The U. S. Coast and Geodetic Survey has continued to act in an advisory capacity to the local control surveys in progress in the states of Massachusetts, Connecticut, New Jersey, Virginia, Florida, Alabama, Louisiana, Arkansas, Oklahoma, Iowa, Ohio, Georgia, and in the counties of Monroe and Westchester, New York, Mercer, Penn-

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* Committee on Field Engineering, 1939

Walter Starkweather, Chmn. .... *Seattle, Wash.*
Lloyd Aldrich .... *Los Angeles, Calif.*
Herbert M. Dibert .... *Troy, N. Y.*
Frederick T. Thorpe, Jr. .... *Philadelphia, Pa.*
B. B. Weber .... *Oil City, Pa.*

sylvania, and King, Washington. These local control surveys consist of triangulation, traverse, and leveling based upon the federal control nets to which they are supplementary.

During the year which ended June 30, 1938, the Coast and Geodetic Survey ran 2,389 linear miles of arcs of first- and second-order triangulation and 2,307 miles of first- and second-order leveling. This work entered 22 states of the Union and was done in accordance with the general plan of extending the control nets into areas where geographic positions and elevations are required immediately for topographic mapping and other engineering operations. The level net has been expanded to the point where, except for a few areas in the mountainous regions of the West, the distance across the level circuit is approximately 25 miles.

In addition to the routine adjustment of primary control by the U. S. Geological Survey there has been in progress a general adjustment of both horizontal and vertical control to agree with the standard datums of the United States. There were 5,410 miles of spirit leveling run, 4,373 miles of transit traverse were completed and 214 triangulation stations were occupied during the year ended June 30, 1938. Eight bulletins reporting the results of control surveys have been prepared, and three that were previously prepared were published for Kansas, Missouri, and Vermont. These are listed in the bibliography at the end of this report.

Photogrammetry

The aerial photographic method of mapping is gaining in favor. There are many areas in the United States in which this method could be applied most economically. The area covered by planimetric maps without contours, resulting from aerial photography, covered 2,077 square miles in four states. By a cooperative agreement with the Tennessee Valley Authority, the U. S. Geological Survey mapped from aerial photographs by stereophotogrammetric methods 1,168 square miles covering in whole or in part 29 quadrangles. Fifteen stereophotogrammetric instruments have now been installed at the Chattanooga office of the Geological Survey.

In the section of photo-mapping of the Geological Survey, aerial photographs were used for the compilation of planimetric bases of sixteen 7½-minute quadrangles or parts of quadrangles in Louisiana and two 7½-minute quadrangles in Michigan, a total of 977 square miles. After the customary field inspection, these maps are

published as planimetric maps. Line bases to assist in topographic mapping were likewise compiled of nine 7½-minute quadrangles in Massachusetts and fifteen 7½-minute and 15-minute quadrangles in Missouri, a total of 1,975 square miles, making a grand total of 2,952 square miles. Thirty-six square miles in Virginia and 49 square miles in Montana were mapped by the stereophotogrammetric method in the Washington office.

National Mapping and Levels

For the year ended June 30, 1938, the area covered by the U. S. Geological Survey with new topographic surveys was 6,875 square miles, resurveys 658 square miles, and revision 650 square miles, totaling 13,583 square miles, which comprises the entire area or portions of 198 topographic maps with contours. Topographic mapping was done in 35 states and in Puerto Rico. Cooperation was had with 16 states, Puerto Rico, and the Tennessee Valley Authority.

Of the area of the United States 45 per cent has been covered by topographic maps by the U. S. Geological Survey, the year's increment amounting to 0.2 per cent. The reduced percentage, as compared with 47.4 reported in 1937, is due to the fact that during the year maps of 79,668 square miles, based on reconnaissance surveys prior to 1896 and considered inadequate, have been withdrawn from distribution and the areas classified as unmapped.

The inadequacy of existing maps and the lack of maps have been forcibly brought out in the federal projects under way, particularly in flood control, soil erosion and in national defense. Through the use of W.P.A. funds, this situation is being improved and mapping work is progressing with reasonable speed and accuracy.

In January, 1920, the Map Information Office, authorized by the Executive Order of December 30, 1919, was organized in the U. S. Geological Survey as part of the Topographic Branch. Since that time it has been conducted entirely by U. S. Geological Survey personnel.

The files of the office contain samples of practically all types of maps published by the federal mapping agencies, many maps of foreign governments and commercial map publishers, catalogs and index maps, and a card index for reference, which is much used by government agencies and the general public. In addition to its functions as a clearing house for map information, the office has also been given the task of collecting, classifying, and disseminating

information concerning all aerial photography throughout the United States, of both a federal and non-federal character.

The office is used as a clearing house for all aerial topographic information similar to that for maps. One of the accomplishments of the year was the compilation and publishing, for the Board of Surveys and Maps, of an index map of the United States on which were shown all areas photographed up to March, 1937.

State Mapping

An important trend in state planning is an awakening to the need for the preparation of complete and adequate maps of an entire state. It is very difficult and sometimes impossible to plan intelligently and effectively for the development and use of valuable state resources without four basic maps—air photographs, topographic maps, soil surveys, and geologic maps.

A knowledge of the scope and requirements of basic mapping is of vital interest and importance to the field engineer and surveyor when interpreting modern trends in state planning. Recognition of the need for these basic maps is shown by the Pennsylvania State Planning Board in its analysis of the status of mapping in Pennsylvania. A description of these basic maps is well presented in the report of the Pennsylvania State Planning Board.

Coordinate Conversion

The conversion of geodetic coordinates to plane coordinate systems and vice versa have received considerable attention in the technical press in order to make these calculations easy to understand and calculate. Several articles on this subject are included in the bibliography in this report.

Geodetic Control

During the past two years there has been considerable discussion among engineers as to the value and practical uses of geodetic control and geodetic coordinates and it appears that there is still a wide divergence of opinion on these subjects.

Land Court

Engineers and surveyors outside of Massachusetts have until recently had little knowledge concerning the functioning of the land

court which has been in operation for many years and may prove to be a valuable system for some other states. The subject is thoroughly treated in the *Proceedings* of the American Society of Civil Engineers for November, 1938.

Preliminary Surveys for P.W.A. Projects

A great many field investigations and surveys for proposed P.W.A. projects have been made recently and the attention of the Committee on Field Engineering has been called to the fact that in many cases the actual costs of these projects have been much higher than estimated. If sufficient stress were laid on the quality or quantity of the preliminary surveys and field investigations, embarrassment of the sponsors might be avoided, as the P.W.A. usually has to refuse additional funds. More funds may have to be expended for proper field engineering prior to planning a project and this additional expenditure may prove to be very worth while.

Instruments and Equipment

American instrument makers have been cooperating to meet the increased demand for finer surveying equipment. A Direction Theodolite and a Precise Level suitable for second-order work are being developed which can be sold at a relatively low price. Sight rods, level rods, and chaining bucks have been redesigned to increase the speed and accuracy of the work.

An easy reading stadia rod is described by H. K. Palmer in the *Engineering News-Record* of March 10, 1938.

In air photography, the remarkable nine-lens camera recently developed by the U. S. Coast and Geodetic Survey has proved its worth. In areas of flat terrain, an increase in efficiency of 20 per cent has been attained, and extension of the same efficiency to areas of considerable relief by procurement of supplemental instruments is anticipated.

The multiplex aeroprojector has recently been greatly improved by the U. S. Geological Survey. This is an instrument for the construction of contour maps from aerial photographs. It is described in *Civil Engineering* for October, 1938.

A stereoscopic contour plotter has been put out by the Bausch and Lomb Optical Company for use in plotting topographic maps from aerial photographs.

In England an instrument has been developed called the Cambridge stereo-comparator for an aid to mapping by aerial photography.

Improvements in stream measurement equipment by the U. S. Geological Survey are aids in this type of work.

All of these items of equipment mentioned are described in articles included in the bibliography at the end of this report.

Methods

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Part Two

CURRENT PROBLEMS IN PUBLIC WORKS

The Administration of Public Works—As Viewed by a Mayor

F. H. La Guardia
Mayor, City of New York

Mr. President, Ladies and Gentlemen: It is a pleasure to extend to you the formal welcome on behalf of the City of New York. I know that you will find your stay enjoyable, and I sincerely hope that you will utilize every moment of your time here so as to obtain from it the fullest possible measure of recreation.

We are very happy to have a Congress of this kind in New York City. We feel that we have made considerable progress during the past four years, both in our politics and in the technique of financing and engineering public works. We have long since abandoned the old hit-or-miss system. In the new charter which was presented to the people for approval a year ago, we advocated a complete and revolutionary change in both the jurisdiction of construction and the maintenance of public works. That charter was approved and becomes effective on January 1, 1939.

I was very much amused to hear the President state that this was your forty-fourth reunion. I wonder what the Congress looked like forty years ago. If I correctly judge the history of municipalities I should say that it must have been composed of politicians.

Public works have been the most desirable object of political machines, and it is a comparatively new idea in municipal government to place control of public works in the hands of trained, experienced career men. This has been brought about by two things. First, a complete change in the attitude of the people of the city toward their local government, and, second, the increased cost of labor and materials, which has made the luxury of political municipal government too expensive to continue.

Naturally, when I started out to reorganize this city government and to place it on a scientific basis, eliminating politics entirely, the first matter under consideration was the public works department. And, I have succeeded in eliminating politics from the city administration. If you don't believe me just visit the clubhouses of both

major political parties and hear the choice and pet names they call me.

Now, I could never see just why a successful and skilled leader of a district in a political party was qualified for the office of Commissioner of Public Works, or Commissioner of the particular department that has jurisdiction over public works, and yet that has been the practice in this city for forty years or longer.

Our old charter spread construction of public works over at least nine or ten departments. Maintenance was spread over five different departments, then known as the Borough governments; sewage disposal, refuse collection and disposal, and street cleaning were in the Department of Sanitation.

Our centralization of all those functions in the Department of Public Works was one of the main points of attack on the part of the political parties against the new charter. However, in the sponsorship of the new charter, we did not dodge the issue but emphasized it. I think it was the opposition to this feature that gave us the opportunity to conduct a campaign of education on that, and also on the Planning Commission, which otherwise might have been too technical for popular discussion.

What we propose to do now is to establish a model Department of Public Works, and I find that in addition to actual professional education, training, and experience, public works, whether municipal, state or federal, is forming a distinct and separate branch of the industry and profession. It requires special training. I need not tell you men that every commissioner of public works or the head of a department or agency of government is hampered, and necessarily so, by a requirement of the law that in private industry he does not have to meet. That is inevitable. Sometimes I feel that these limitations and requirements of law were put there for anything but the purpose ostensibly contended, but in the long run, the requirements of public bidding, specifications, and advertisement perhaps after all are necessary safeguards to government business.

Need of Chance for Career in Public Works

If public works is to develop as a specialized branch of the industry and profession, then it goes without saying that we must have a greater field. By that I mean that we must work out some arrangement for the interchange and promotion of engineers and architects

who enter this field. Take a city like New York, where perhaps our Public Works Department is larger than any in the country with the exception of the federal government. Surely, it is larger than that of our own state, and, we probably have a greater turnover than any department of any state or any other city. However, even that is not sufficient to insure a life's work to the young engineer who enters at the bottom of the ladder. My suggestion is the same as that made to the career men of the Public Health Department in this city. They too are working in a limited field because between public health, which is preventive medicine, and curative medicine, there is no relationship. The young man who enters the public health field ought to have a wider and a broader scope of improvement and promotion. The same is true in public works.

The junior engineers, the senior engineers, and the deputy commissioners of the large cities should be available to head departments in smaller cities, and, as vacancies occur in the larger cities, there should be an arrangement working toward the advancement of such career men. Such a plan may involve changing the civil service laws to create a national field for public works officials so that promotion will be ahead of them, even though they may be working in one of the smaller communities.

Certainly it is to the advantage of the community and surely to the morale of a department if the engineer knows he is engaging in a permanent life's work. He does not have to curry favor with any group of men; he does not have to be a good fellow with private industry; and he can exercise that independence and judgment which are so necessary in the efficient and competent performance of public duty.

The relationship between the federal government and the municipal governments is now closer than it has ever been in the history of our country. I don't know how many of you represent state commissions or state departments nor how many are from local units. It so happens that in this state we have an excellent Superintendent of Public Works, one who knows his job very well. And, any friction heretofore existing between the city and the state, so far as these departments are concerned, has all been eliminated. Up to the time the politicians tried to step in and interfere with the Superintendent, our relations here in New York City between the Department of Public Works and the federal government have been most satisfactory and happy. That is easy, because my Depart-

ment of Public Works knows that I will brook no interference from any source.

Proposal to Pool Municipal Purchases

Now then, if we had an arrangement between cities and states so that these career men could see something ahead of them, I think we could establish an exchange of information as to both qualities of material and prices. I don't think it will come as a shock to any of you experienced men when I say that once in a while we are confronted with a ganging of material men who are fixing prices. If it has not happened to your city, well, you have either done no building, or you are very fortunate. We find it, and a closer interchange of information and prices would be very helpful. When all of us know what the others are doing, not only do I see the possibility of eliminating price fixing, but in time we might be able to establish pool purchasing.

I have already taken the first step toward that end through negotiations with the Procurement Division of the Treasury Department and the Secretary of the Treasury, for an amendment to the Federal Purchase Law which would permit municipalities to take advantage of contracts between the federal government and material men and providers of other equipment and supplies that cities need. As you know, the federal government makes contracts annually for almost all the supplies it needs, and it gets a most advantageous price because of the quantity purchased. I feel that it would be a great saving to cities, and particularly the smaller cities, if they could simply take advantage of the contracts which the federal government has and draw upon them, purchasing directly from the contractor and paying the price agreed upon by the federal government.

In such staple articles as cement, asphalt, chlorine, brick, steel, and other supplies and equipment, such a plan would result in a very big saving. We have advanced now to the stage of agreeing on the form of a bill. It was introduced into the last Congress, but it has not yet received legislative consideration. I am hopeful of pressing the bill with the new Congress. If your organization will take an interest in it and study its provisions, the United States Conference of Mayors will be very happy to receive your suggestions. I think you will find it is sufficiently broad, and if you believe it would result in a saving of time as well as cost to your communities

and states, we will be very happy to get your support for the passage of the bill.

Functions of the Public Works Department

I find that in some of your discussions here you take up the matter of conflict of jurisdiction. It has been our experience here that the Department of Public Works should be limited to just that, including, of course, the maintenance and repair of all buildings. We have separated the operation of ferry boats from our Department of Public Works and I think on the whole it was a good thing to do. We have placed the construction and maintenance of sewage disposal in the Department of Public Works, having taken it away from the Street Cleaning Department. Our schools are not under the jurisdiction of the Department of Public Works, the School Department having its own division. I don't know how important that may be in your community, but in this city the cost of building schools averages a little over $25,000,000 a year. I found a most hopeless and discouraging, if not disgusting, situation in the Division of Building of the Department of Education. It took me four years to clean that up, even though, mark you, I had control of the Board for at least two years and a half of that time. The situation was very firmly entrenched, and it was so politically protected that at the head of it was a man who had become an architect through an act of the legislature. However, we now have competent engineers heading the construction of new schools.

We also separated the maintenance and repair of schools. When I tell you that we have a school budget, entirely exclusive of new buildings, of $164,000,000 a year, I am sure you will get an idea of what maintenance and repairs mean to a system of that kind.

I note you have a discussion here on the matter of traffic control, considering whether it should be in the department of public works or in the police department. Take my advice, stay away from it. Let the police handle it. There are more traffic experts in this country than any other you can name. You can go downstairs into the dining room of this hotel or any hotel immediately after lunch and I will wager that no matter where you go you will find some soap manufacturer or a manufacturer of ladies' bloomers drawing designs of traffic control on the white tablecloth. Everybody is a traffic expert. It is the most vexing and difficult problem we have. Of course, the engineers could solve it very easily by the simple device

of widening streets and providing parking spaces. The only trouble with those plans is that there is not a city in the country that has the money to carry them out.

Without exaggerating, we have spent on traffic control during the last twenty-five years well over $100,000,000. Well over that, I am sure. We have spent that in parkways, street widening, and bridges. Every traffic improvement that is created—and you heave a sigh of relief when it is completed—only creates traffic congestion in other parts of your city. We talk about bridges, and to build bridges is comparatively easy and inexpensive, but to get the necessary approaches for those bridges just ruins you. I have a tunnel now that I will be glad to give to any of your cities if you will only give me the approaches.

The engineering side of traffic control I believe can be easily separated from the actual traffic supervision, and I would not want to see my Department of Public Works getting involved in the police end of it. We are operating most of our traffic utilities through the media of authorities. As you know, our bridges over the East River, Brooklyn, Manhattan, Williamsburg, Queensborough, are free bridges and they are under the jurisdiction of the Department of Public Works. Any bridge engineer here can appreciate the responsibility and the difficulty involved in maintaining bridges of that character.

Now the Tri-Borough Bridge is operated by the Tri-Borough Bridge Authority and the reason for that, as you can readily understand, was its financing. We are limited here by a debt limit and a tax rate limit, as are most cities, and therefore we could not add to the city debt a single item.

Just to give you an idea of what I mean by competent men to run public works, I will tell you briefly of what I found in the Tri-Borough Bridge Authority when I took office in January, 1934. The first thing I knew was that they had negotiated a loan with the old R.F.C. Naturally we looked into the plans and there we found as the Chief Engineer a gentleman who had been in politically appointed offices for thirty years or over. A monument to his great genius is the Fifty-ninth Street Bridge across the East River, and I shall be glad to give the technical side of that to any engineer who is interested. Then we found a Legal Department as costly as the Engineering Department, and what the lawyers were going to do, I don't know. Next we found the Commission to be com-

posed of a real estate agent, a retired policeman, and an active district leader who was a very able and competent lawyer—which makes it all the worse.

They had the most magnificent bridgehead of monumental design that I have ever seen, smack at the head of the bridge, with no provision for approaches. Well, I come from a race of people who invented monuments of marble and I was naturally interested. Surely enough we found that a group of politicians had taken an option on a quarry in a nearby state. We examined the plans and found that the engineers had not taken advantage of the improvements in the science in bridge building. Mark you too, this Authority was appointed for a fixed term. Well, I knew it would not be hard to nip the real estate agent, and my first hunch was right. We simply examined the lease of the office they had rented and found that he had paid himself a commission for renting from himself an office for which he was agent. I put him under charges and he resigned. Then we took the policeman and I put him under charges for incompetency: we asked him a few questions on stresses of bridges and weights of girders and strength of cables and that was the end of the policeman.

Well, that gave us control of the Authority. We junked the plans with the monumental bridgehead and proceeded to design proper approaches and I invite and shall appreciate an inspection of the Tri-Borough Bridge. You will find it the last word in approaches and in bridge construction, and you will also find there the living example of the cost of bridges. The original approaches cost us $18,000,000 over and above the estimated cost of the bridge itself, and if you will go to the Bronx you will find it is now constructing a westerly and easterly approach in addition to the approaches we figured would be sufficient for the next twenty years. These two approaches will cost about $14,000,000. So, when you consider bridges for your home town, don't forget the approaches.

The tunnels under the Hudson River are operated by the Port Authority, made necessary by reason of the jurisdiction of two states. It is an independent body with an excellent engineering staff and a very splendid maintenance and operation division.

The Henry Hudson Bridge, which connects the West Side Highway with the highways in Westchester, is under the jurisdiction of the Henry Hudson Commission consisting of one man, and that man is Robert Moses, and even if he is on a commission of five men

that commission still consists of one man. The Queensborough Bridge also is worthy of inspection because it will connect with a new chief artery which will rim all of Queens and Brooklyn.

Current Construction in New York City

From all this you will find that we think we have made some progress in establishing permanency in our department and in putting it on a purely scientific and sound engineering basis. We have some large projects now in the course of construction in which you may be interested. There is the new Criminal Court Building and Tombs which will cost in the neighborhood of $18,000,000. Anyone interested in foundations will find some very interesting problems we have to meet in the foundation of that large structure. Hunter College is a large $15,000,000 building now in the foundation stage as is the Tri-Borough Tubercular Hospital.

Our housing unit in Red Hook is an $18,000,000 public housing project. If any of you are interested in that perhaps you would like to examine the plans and the work itself. For a complete occupied housing unit I would recommend that you inspect Williamsburg Houses, where we have some sixteen or eighteen hundred families. These houses, of course, represent hardly a fair test in public housing because frankly I do not believe we will ever be able to repeat our success there. The project contains many luxuries and is of costly construction that could hardly be repeated in low-rent housing units again. The same is true of our Harlem Unit up here in West Harlem.

Now, if there is any particular department of the city you care to inspect and examine, we will be very glad to arrange for it. I would suggest that our department make the necessary arrangements with the Secretary of your Congress so that you can get together and have as many as possible going to particular places of inspection, and we will provide transportation. After you have selected the place you wish to visit, I hope you will withhold any information up to the last moment, because I don't want a dress parade. I would like to have you examine the works or the department without any advance notice. That is the way I make my inspections so if there is anything wrong let me know, and if it is okay just keep quiet about it.

I want to thank you for this opportunity to address you and I want you to feel that we are very vitally interested in your organiza-

tion and in the progress we feel can be made and should be made in establishing permanency in the departments of public works, and in divorcing it entirely from politics. After all, with a change of administration, whether municipal or state, the politics is changed, but there is no Democratic or Republican way of laying a foundation or building a bridge. The engineering remains the same, and the construction remains the same, changing only with improvement and progress in the art of building. That is why it is so necessary that public works, along with public health, hospitalization, education, sanitation, parks, docks, etc. have continuity of direction, and that only a change in policy is brought about by a shift in political leadership. When we achieve that, we will have our local governments on a scientific basis. I thank you.

Response to Address of Welcome

L. W. Herzog

State Administrator, Works Progress Administration, Albany, N. Y.

Mr. President, Mayor La Guardia and Fellow Members: On behalf of this Association I want to express to you our deep appreciation for personally welcoming us. We are accustomed to having a stereotyped address of welcome in which the Mayor says how happy he is to have us with him and extends to us the keys of the city, and then gets out as quickly as he can. Everyone here will realize now why the government of Mayor La Guardia is so popular in New York City, and not only in New York City but in the entire country as well. When a mayor comes to an association of this kind and gives a discussion of his philosophy of public works government, I would say that is unique.

The Mayor has said that he is always on the spot in the clubhouses, and consequently you can readily realize why it is necessary for him to have a knowledge of governmental functions. It is generally known in New York State that before you go up against Mayor La Guardia in a public discussion of governmental functions, you better start training with a grizzly bear, or you will come out rather badly clawed.

I am quite sure that Mayor La Guardia's remarks will be men-

tioned very often in the discussions of this Association. I do not believe in the forty-four years of our existence have we ever had a mayor who gave us a really constructive talk on public works and the government of a city. It is a little different from what usually happens and the Mayor is noted for doing things a little differently than most public officials.

Mr. Mayor, on behalf of this Association please accept our heartiest thanks, not only for your welcome and the discussion you gave us, but for assigning your efficient assistant to arrange for our entertainment during our stay. We hope that when we leave the City of New York will be as sorry to see us go as we will be to leave.

Broad Aspects of Public Works in New York City

E. J. McGrew, Jr.

Deputy Commissioner of Public Works, New York, N. Y.

The trend of public works development in New York City has, as in the rest of the country, been toward the centralization of authority for a number of years. This has been particularly true in the present century.

On January 1, 1898, the Greater City of New York came into being. Prior to that time, those geographical areas making up the present City of New York were separate political subdivisions. The present Borough of Manhattan was the then City of New York. The present Borough of Brooklyn was the City of Brooklyn. Bronx, Queens and Richmond, which are now boroughs of the Greater City, were counties, made up of a number of scattered villages and towns. One of the world's great public works, Brooklyn Bridge, completed in 1883, was the first physical link between the then City of New York and the City of Brooklyn, and started the tendency that resulted in one great integrated city.

With the consolidation of the Greater City, came the first city-wide department dealing in public works. It was known as the Department of Bridges, and took over the maintenance and operation of a number of scattered bridges throughout the five boroughs,

including the bridges over navigable waterways, connecting the boroughs. The next step came with the formation of the Department of Plant and Structures in 1916, which was created with the conception of a broad department handling public works. Though the responsibilities for the department were broadened to take in the operation of ferryboats, as being intermittent highways between the boroughs, the vision of the creators of the department was never realized until the people of the City of New York adopted a new charter in November of last year, which brought into being on January 1, 1938, the first Department of Public Works in fact, in the City of New York.

During this same period, a parallel development was occurring in the Departments of Sanitation and Parks. Street cleaning and disposal of refuse were not brought under one central control until 1929, with the formation of the Department of Sanitation. Back in the 60's, problems of sanitation, which we now associate with the modern Departments of Street Cleaning and Sanitation, were handled by the Department of Health. In 1870 street cleaning was transferred to the Police Department, and it was not until 1881 that a separate Department of Street Cleaning was created for the then City of New York, and even under the consolidation of 1898, this department functioned only in Manhattan, Brooklyn, and the Bronx. It was not until 1930 that the responsibility for cleaning the streets in the Boroughs of Queens and Richmond was transferred from the respective Borough Presidents to the new Department of Sanitation.

Prior to 1934, the parks of the city were managed by five separate Park Commissions, which were consolidated into the Department of Parks of the City of New York on the first of January of that year. It has been only since that consolidation that the great expansion of park facilities, recreation centers, swimming pools and driveways has grown by leaps and bounds under that department's great Commissioner, Robert Moses, with whose work most of you are familiar.

The depression years following 1929 introduced a new era in the field of public works. To meet the difficulty of financing large-scale works, an "authority" was created as an instrument for producing the facilities required without employing the credit of the political subdivision requiring these facilities. In the New York area an outstanding model of this new element had been operating

successfully since 1921. I refer to the Port of New York Authority, created by joint compact with the States of New York and New Jersey for the development of transportation and other facilities for the port of Greater New York. From this start sprang successively the Tri-Borough Bridge Authority, New York Tunnel Authority, New York Parkway Authority, and New York Housing Authority.

With this background, we now turn to public works development as we find it in New York City today. Many of you gentlemen are from smaller communities; some from other populous cities of the country. We, therefore, all know that the smaller the community, the broader is the field in which the individual engineer or public official, dealing with public works, finds himself. As we go from the smallest community to successively larger ones, we come to the largest city in the country where a high degree of specialization is essential and many subdivisions are required to create the several types of engineering works which we think of as "public works."

The Department of Public Works, itself, designs, constructs and operates bridges over navigable waterways, or having a terminus in two or more boroughs, sewage disposal plants and intercepting sewers (but not local sewers), and buildings. Additionally, it designs and constructs (but does not operate) police stations, fire houses, health stations, hospitals, welfare clinics, correction institutions, public markets; and garages, incinerators and section-stations for the Department of Sanitation.

The scope of this department is broad, but you have undoubtedly noted many exceptions. The paving and repair of streets, and the construction of local sewers were reserved, under the new charter, to the five respective Borough Presidents. All parks, parkways, and appurtenances thereto are under the Department of Parks. All waterfront property, improvements to waterfront property, and docks, are placed under the Dock Department, along with airports and the operation of ferries. The Board of Water Supply is charged with the design and construction of sources of water supply and aqueducts for delivering that water to the city. The distribution systems and the management of the water department are under the Department of Water Supply, Gas and Electricity. The design and construction of the subway system and the operation of the city-owned independent subway system is under the Board of

Transportation. The cleaning of the streets and disposal of refuse is in the hands of the Department of Sanitation.

You may be interested in the volume of this activity. I will not burden you with a great many statistical facts, but will illustrate by the Department of Public Works itself. The Department of Public Works maintains and operates: 48 bridges (including the Queensboro Bridge, with the heaviest traffic in the world, and the Brooklyn Bridge, the oldest long span suspension bridge); 18 sewage disposal plants (including the Wards Island Plant with a capacity of 200 M. G.); and 76 buildings. The aggregate value is $300,000,000.

The design and construction program of capital improvements under the charge of the Department of Public Works encompasses: construction and design of 31 bridges, estimated at $20,000,000; 18 sewage treatment plants estimated at $26,000,000; 114 buildings and related structures at $84,000,000; or a total estimate of $130,000,000.

This is approximately 55 per cent of the total capital improvement program of New York City, which amounts to $239,000,000, the remainder of which is largely the responsibility of the other departments mentioned.

GENERAL DISCUSSION

Mr. L. G. Lenhardt (Detroit, Mich.): What are the Division's responsibilities, and the relation of your Engineering Department to your various other departments?

Mr. McGrew: I will attempt to give you a brief picture of the thing. Public works in New York City are not centered entirely in the Department of Public Works as in most other cities. As we all realize, the greater the task, the greater the number of subdivisions required to handle it, and the greater the specialization in the respective subdivisions. In New York City there was a gradual centralization from 1898 forward. That was the year of the consolidation of the Greater City of New York. Prior to that time New York City was Manhattan Island, the City of Brooklyn was the Borough of Brooklyn, and in the Bronx you had a number of scattered small villages.

In 1916 there was an attempt at a Public Works Department which never became a public works department in fact. It was an outgrowth of the old Bridge Department to which was added supervision of ferries. On January 1 of this year, as a result of our new

charter of last fall, the Department of Public Works was created in fact. It operates bridges over navigable waters and not over railroads. It operates sewage disposal plants and intercepting sewers and it operates buildings. There are 48 bridges in the department ranging in size all the way from the Queensborough Bridge, which is the most heavily traveled bridge in the world, to the old Brooklyn Bridge and right on down to the small structures. There are 18 sewage disposal structures, ranging in size from the Wards Island Plant of 200,000,000 gallons capacity to quite small obsolete screening plants. There are some 70 buildings ranging in size from 26-story municipal buildings down to small court structures. The aggregate property value is $300,000,000.

The three subdivisions I have described to you are functional subdivisions in the Department. In addition, the Department designs and constructs hospitals, health stations, police stations, fire stations, and incinerators for the Department of Sanitation; markets, welfare and correction institutions, and in fact all other public works except schools, which are under the Department of Education; parks, which are under the Parks Department; water front facilities, docks and airports, which are under the Dock Department; water supply facilities which are under the Board of Water Supply for construction and under a Department of Water, Gas, Electricity for operation; and subways under the Board of Transportation. Those five are public works as we all conceive them but they are designed, constructed, and operated by other than the Department of Public Works.

The aggregate value, if it is of interest to you, of the New York City works program at the present time is nearly $250,000,000, of which 55 per cent is lodged in the Public Works Department itself.

The internal organization of the Department is broken up into the functional groups of sewage disposal, buildings, and bridges for operation and design and construction, under an Engineering Division with a Bureau of Architecture as a subdivision, handling largely the architectural features of all of these other departments. We handle our own design internally on all of those engineering structures which we operate. On these hospitals, health stations, police stations, fire stations, etc., we contract with private architects who design and supervise the building under the direct control of our own architectural bureau.

Mr. F. J. Thorpe (Philadelphia, Pa.): Do you have an independent Department of Surveys?

MR. McGREW: Do you mean a city-wide independent Department of Surveys?

MR. THORPE: Yes.

MR. McGREW: In the new charter of January 1 there was created a City Planning Commission. It has been in existence only since the first of the year and it is just now getting organized. It will control a master plan for the city which, in effect, may develop toward your independent planning and survey. At the present time it is functioning more in fiscal planning, and the adoption of broad policies with respect to public works rather than with detail. Internally, we have our survey section.

MR. R. L. ANDERSON (Winnetka, Ill.): How about the Maintenance Department? Is that independent of your Public Works Department?

MR. McGREW: Yes. Like all charter revisions the new charter of January 1 was a compromise arrived at by the Charter Revision Commission as a compromise between a full centralization of public works, which I understand they would like to have had, and the practice they thought would be accepted by the voters.

So, back of 1938, we had five separate Borough Presidents under whom were street construction and street maintenance, local sewers, and buildings. They took from those Borough Presidents the buildings, but left with them local sewers. Largely for financial reasons in that local sewers are constructed by assessment and intercepting and sewage disposal plants are city-wide. They also left with them the construction and maintenance of streets, so today you have in each borough a separate department of street maintenance and street construction as well of local sewers.

Street cleaning was centralized in the Department of Sanitation in 1929, but not until 1933 was that department in fact a central street cleaning department for the entire city.

In passing I might say that our Parks Department, which has expanded the driveway and park facilities and recreational facilities so enormously in the last four years, was created from five separate park commissions, one in each borough, which existed prior to 1934.

MR. A. PAV (Berwyn, Ill.): Does your Department of Refuse Disposal come under the Public Works Department or is it under the Department of Sanitation?

MR. McGREW: That is with the Department of Sanitation.

MR. PAV: We in the small suburbs are confronted with a lot of

vacant property that has been overgrown with ragweed and other noxious weeds. Would that be under the jurisdiction of Sanitation or the Department of Health? We have had quite a lot of discussion in our local government about that, trying to decide who is to have charge of it. How do you handle that matter?

MR. McGREW: That same discussion of allocating jurisdiction is prevalent here. The borough presidents are directly responsible for vacant properties. The Department of Sanitation is directly responsible for the filling of vacant property. The Health Department is responsible for mosquito control and such other operations as are largely directed toward vacant property—so that that is not clearly defined here as yet. The details of operation, however, had best be left to somebody from the Department of Sanitation you can corner on that. I prefer not to be too definite on the subject as it is completely out of my sphere.

MR. F. T. THORPE (Philadelphia, Pa.): Under what department of the administration do your zoning laws come?

MR. McGREW: Under the new charter the Planning Commission will have charge of zoning.

MR. THORPE: Was that formerly controlled by the Board of Estimate?

MR. McGREW: Yes, and I think that it still has to be approved by them.

An Appraisal of the W.P.A.'s Accomplishments

PERRY A. FELLOWS

Assistant Chief Engineer, Works Progress Administration, Washington, D. C.

THE PROPOSAL to appraise the accomplishments of the Works Progress Administration brings up at once the question of impartiality. From what point of view can an impartial appraisal be made? It is easy to think of a dozen points of view from which appraisals of the work-relief program are being made, in all honesty, which nevertheless fall short of impartiality. Indeed, when we think

of some of these current appraisals, so strictly relative to a specific and narrow point of view, we are reminded of Einstein's theory of relativity. There is certainly a great deal of relativity in our views of a social-economic situation.

To take only three examples, there are the specific points of view of the W.P.A. worker, of the city engineer, and of the academic economist—from which widely differing and equally sincere appraisals of the W.P.A. program might be and in fact are being made. The W.P.A. worker, though glad enough to have a job on any terms, may complain that it was seven weeks after he lost his factory job before he got work-relief, and that he cannot support his family properly on W.P.A. wages. He may ask what is the use of his getting the prevailing rate of wages per hour when the number of hours he is permitted to work is sharply limited. These criticisms, explicit and implicit, may be well founded from his point of view, but they obviously do not take all the facts into consideration.

But is our city engineer's rough-and-ready appraisal any better? The city engineer may be convinced that the greatest need of his city is for new school buildings, and he may be impatient because the W.P.A. has disapproved a proposed project for a new schoolhouse, and has approved instead a project for the laying out of a new city park. He is, of course, aware of the reason—namely, that there are not on the relief rolls of the town enough skilled workers to build a schoolhouse, while there are plenty of unskilled workers such as can be used on a park project. This reason, from the point of view of the city engineer, is a poor reason. If he were running the program, he would hire skilled workers from outside the relief rolls. He ignores the chief purpose of the W.P.A., which is to provide employment for the needy unemployed.

Can we, however, expect a greater degree of impartiality from the academic economist? He will tell us, if I am not mistaken, that the W.P.A. program is a mere palliative and not a cure of our economic ills. He will tell us that if the federal money spent on work-relief were put into the economic machine in some other way—and he would have his own pet way to suggest—a far greater economic improvement would result in a year or two. What the unemployed and their hungry families are to live on in the meantime he does not tell us.

There are many other such points of view, from all of which it

is equally impossible to get an impartial appraisal of the W.P.A. program. Yet an impartial appraisal is, I think, not at all impossible to get. It is only necessary for us to consider what the W.P.A. was set up to do, and then consider whether, or to what extent, the W.P.A. is fulfilling its own specified purposes.

Why the W.P.A. Was Organized

Approaching the subject in this way, we should remember that our federal work-relief program in the first place was created to meet a great national emergency, and it has been continued, with various changes, in the form of the W.P.A. because the unemployment situation which it was designed to meet has itself continued. The federal work-relief program was instituted under a popular mandate by the representatives of the whole American people. The purposes of the work-relief program are clearly defined in the various laws by which the program has been established and controlled. And from year to year Congress, after thorough discussion, has appropriated funds for its continuance. This, though it cannot be regarded as a scientific appraisal of the work-relief program's accomplishments, is nevertheless a fundamental kind of social appraisal. It means that in the view of the American people, as expressed through their elected representatives, the work-relief program is accomplishing its purposes well enough to warrant its continuance.

Now what are these purposes? First of all, it must provide employment for the able-bodied unemployed. Second, it must do work useful to the public. It is perhaps a tribute to the success of the work-relief program in carrying out its primary responsibility, that of providing employment to the unemployed, that we today are inclined to put so much emphasis on the second purpose, that of doing useful public work. Indeed, some of us—like the impatient city engineer to whom I have referred—are already paying this work-relief program the left-handed compliment of blaming it because it is not a first-rate city-planning program.

I do not wish to suggest that the W.P.A. is a perfect or ideal program even in its primary aspect, as an employment program to meet the needs of the unemployed. The funds appropriated to carry it on have never been sufficient to employ every needy able-bodied unemployed worker. And from this fact there flow various practical administrative consequences, one of which is that the

W.P.A. must restrict its employment to the neediest of our needy unemployed workers. This means in practice that our local communities investigate applicants, and certify to us for W.P.A. work only those applicants who lack not only jobs but any other resources on which to exist. Such investigation is at least one of the causes of the delay of which, as I suggested a moment ago, a W.P.A. worker might complain. The adequacy of work-relief wages is another point on which our present program is still open to criticism and future improvement.

Though considerably short of ideal perfection from various points of view, the W.P.A. program has nevertheless been able to give employment with comparative quickness to workers not needed by private industry, and has made its work-project arrangements so flexible that workers can be released immediately for private industry when they are needed. This is one of the remarkable aspects of our work-relief program. From a high of about 3,000,000 in the early part of 1936, employment on W.P.A. projects dropped to less than one and a half million in the summer of 1937, and has risen again to 3,000,000 in recent months.

The W.P.A. employment program has also demonstrated its capacity for rapid employment of jobless workers, under special circumstances, as for example along the Ohio and Mississippi Rivers during the 1937 floods, and again at the present time in the disastrous storm and flood emergency in the New England states. Right now more than 100,000 W.P.A. workers have been mobilized within a few hours to perform rescue work, to help protect the population from flood dangers, and afterward to remove debris and to repair and reconstruct essential municipal utilities.

A part of the responsibility of the federal work-relief program has been to provide the kind of work that our unemployed workers can do. There are many women who are the sole support of their families, and the W.P.A. has found appropriate work for them, on sewing projects and as nurses, teachers, or in other special work. There are on the relief rolls men and women with all types of experience and ability. The work program has therefore a wide range of projects intended to make use of these abilities as far as possible.

The employment provided by federal work projects is intended to be temporary, and one of its objects is to maintain existing skills by practice, and to train or retrain workers to make them better fit for private employment. As far as possible, workers have been put

to work at their normal trades. Many previously inexperienced workers have gained experience and skill on W.P.A. projects sufficient to enable them to get in private industry better jobs and more pay than they could have got without this W.P.A. apprenticeship. Moreover, foremanship training schools have been organized in the W.P.A., and many workers have learned to direct operations in a way which increases their economic value to the community together with their private job and wage prospects.

There has also been a continuous training of W.P.A. workers and foremen in safety practices on the job. As a result of this training the W.P.A. has a safety record which compares favorably with that of private industry, and it is sending into private industry a continuous stream of workers who are safer to work with than they were before.

The temporary nature of W.P.A. work is not a theory but a fact. Less than 15 per cent of all the W.P.A. workers who were on the W.P.A. when it started are still there today. Millions of W.P.A. workers have returned to private industry, and their places have been taken by millions of others displaced from private jobs.

Perhaps I should add that the federal funds provided for the employment of the unemployed are used economically for that purpose. Out of every federal dollar, 85 cents goes into W.P.A. wages, 11 cents for materials, machinery and the other necessary appurtenances of a work program, and only 4 cents for administration.

When we combine the W.P.A. dollar with local sponsors' contributions we find that 67 cents of this combined dollar goes for W.P.A. labor; 3 cents for administration, and 30 cents for materials, equipment, special supervisory wages, etc.

Importance of the Work Done

I have dwelt purposely upon this primary function of our work-relief program because I wish to emphasize the fact that it constitutes the chief criterion by which the work program should be judged. At the same time it has a second function of great importance—the doing of useful public work. The purpose of the federal work-relief program would have been only half accomplished, and it would be open to the gravest criticisms on that score, if it had failed in its second purpose.

So we are justified in asking: has the high labor turnover of the W.P.A., its attention to so many kinds of work, its efforts to accommodate itself to the needs of private enterprise, its solicitous economy in the use of its funds—has all this kept it from doing really useful public work? The responsibility for determining questions of design and methods of construction rests, of course, in the hands of the sponsoring agencies in our local communities. The necessary engineering work is performed either by the regular engineers of the sponsoring agencies or by private consulting engineers employed for this purpose by the local communities. If we were to consider these projects in technical detail, we should be appraising the comparative competence of our local governments in planning public works. What we are considering is rather the broader question of the public usefulness of these projects which have been approved by the W.P.A. as appropriate for W.P.A. assistance.

The W.P.A. has issued a report summarizing its physical accomplishments during its first two years of operation. With your indulgence I shall quote a few figures covering just six of the program's major types of activity.

First: W.P.A. projects have paved more than 16,000 miles of thoroughfare and have provided drainage, grading, and other improvements for 187,000 additional miles. They have also constructed or improved more than 37,000 bridges.

Second: More than 12,000 new public buildings have been built, and 36,000 have been remodeled or otherwise put in condition to last longer. School buildings predominate. I should like to emphasize the benefits which institutions derive from this class of work. The new college buildings alone will have a marked effect on education for years to come.

Third: About 4,300 miles of new water mains and aqueducts have been provided, and 6,300 miles of new sewers. Public health has been further promoted by the construction of 243 new sewage treatment plants and by additions which serve to increase the capacity of 151 previously existing plants.

Fourth: The development of aviation has been expedited by the construction of 130 new airports and the enlargement of 136 others.

Fifth: The W.P.A. has improved and landscaped more than 37,000 acres of parks, playgrounds and athletic fields, and has furnished

thousands of recreational facilities, such as swimming pools and tennis courts. Also more than 26,000 acres of other public grounds have been landscaped.

Sixth and last to be mentioned here: Water conservation and flood control have been promoted through the construction of many dams and dikes and more than 1,000 storage tanks and reservoirs.

As to the value of this work, we fortunately have independent testimony. The accomplishments of the federal works program have been studied and reported upon in a United States Community Improvement Appraisal conducted in 42 states by representatives of professional societies in the fields of engineering, economics, sociology, and government. Examine the reports of these trained, scientific observers. They have examined very thoughtfully the record of the W.P.A., and they have found it good.

But I do not wish to leave the impression that the Community Appraisal is uniformly a paean of praise. It contains much judicious criticism. And, what interests me and I think will interest you, the State Appraisals are almost unanimous in emphasizing the need for more local and state-wide planning of projects, more coordination of state and local planning with W.P.A. project work, in order that the public work done by the W.P.A. shall more fully represent the needs and aims of each community. Recognizing the specific limitations of a work-relief program, these appraisers are nevertheless convinced that the aims of city and state planning and of our work-relief program can be dovetailed successfully.

Except for some statistics on W.P.A. construction activities, I have said little about those aspects of W.P.A. work which, it might be thought, would be of prime interest to this audience. But I have spoken as I did for a reason with which I think you will sympathize. Public works construction has now entered upon a new era, in which it is necessary, as it never was before, to consider the needs of the worker. I think that this new era is a permanent one. Regardless of what particular methods we may henceforth use for the care of the unemployed and the construction of public works, these two important features of our civilization will continue to have an intimate relationship. We shall never again be able to forget the workers' needs in any program of public works construction.

Indeed—and I shall close with this note of speculation—it may

be that public works construction will be the stepping-stone, as it were, for all industry, between the old era and the new—the branch of industry in which that transition was first successfully made. It will no doubt be difficult for industry in general to learn to take primary account of the needs of the worker. It has not been easy for many of us in public construction work. But we have had to learn the lesson. And now that we have learned it, will we become in our turn teachers to a vaster American audience of pupils in industry at large? I leave the question to you.

DISCUSSION

L. G. LENHARDT

Superintendent, Board of Water Commissioners, Detroit, Mich.

THERE is no question but what the W.P.A. has performed some very meritorious work in the line of construction. The earmarks of the program can be seen all over the country in many fine improvements. But how are these improvements going to be maintained? With communities straining every effort to find welfare funds, and funds for materials for W.P.A. projects, maintenance funds are becoming more and more difficult to secure. We see park projects which involve face-lifting work of major magnitude, and yet the grass remains uncut; public buildings are being given major surgical operations and yet the balance of the building remains dirty and unpainted; more roads being built when there is not enough money to maintain existing roads properly; new water mains are being laid while the older mains need cleaning so badly that pressures are inadequate for fire protection; streets are being widened when the cleaning forces are inadequate to service the existing street.

I believe those of us in the northern latitudes have all had the experience of being literally snowed under without adequate funds to take care of the situation, and yet have had W.P.A. projects close down because the men could not get to the work or work on other jobs because of the snow. Even after streets are made fairly passable, there is still a tremendous amount of work which could be done to make travel safer, and yet we have not been allowed to use the W.P.A. workers, who thus stayed at home while the community suffered.

Is not maintenance the proper field for W.P.A. activities rather than construction work? Maintenance is always with us. Objection can be raised that this would eliminate maintenance men from the community payrolls, but in view of the depression I believe almost every governmental agency has its forces tremendously curtailed and could all stand additional help on maintenance activities. By making a condition that present maintenance forces be kept, the W.P.A. workers could be used to augment the regular forces.

This would seem like a more sensible arrangement and much sounder management. Likewise the local units could absorb such work without increasing present personnel and could assume complete responsibility, which at present they are often unable to do. The result would be that the ever-increasing criticism of governmental interference in local affairs could largely be allayed.

L. W. Herzog

State Administrator, Works Progress Administration, Albany, N. Y.

Speaking as a public official, which I am rather than a W.P.A. administrator, I think public officials and particularly public works officials look at the Works Progress Administration from other than a social viewpoint. Perhaps we are hard boiled, and perhaps we are not quite humanitarians in that respect, but we do look at it in the light of efficiency. The accomplishments of a program of this kind, regardless of the social benefits to the men who are employed, depend entirely on what you yourselves would put in it. Nothing is worth more than what you consider it to be worth, and if you consider a program of this kind of any value at all, then you should put your efforts into making it as efficient and as valuable as possible.

I have heard a great deal in the past about the shovel-leaners on W.P.A. projects and the inefficiency on W.P.A., but let me tell you gentlemen that I will take the W.P.A. crews in the state and I will put them up against any public works crew in the State of New York, either city or state, for consistent and efficient work, because the work amounts only to what the supervision is. You can take the best crew of workers in the world and give them poor supervision and you won't get any place, and you can take poor workers with good supervision and they will produce results. I will say what very few public works officials can honestly say—that

any supervisor we find in the State of New York who is doing a poor job is immediately dismissed.

We have a rating scale of poor, fair, and good. When a field engineer contacts a job and puts in a report of "supervision poor" with explanatory remarks, saying why he considers it poor, then the supervisor is either immediately discharged, or if there are some extenuating circumstances, he is given a leave of absence for thirty days without pay.

If the supervision is considered fair, then the Director is told to contact, or have his engineer contact, that supervisor and tell him that he must produce better results or he will face dismissal.

If the supervision is marked good, that is the end of it, because after all that is what we are paying the supervisors for. We don't tell them "you are doing a good job," as we assume that they know they are doing a good job.

It may be that you are taking some of these statements with a grain of salt and are saying, "He is just talking because it happens to be his own administration," but if you are traveling through the state on your way home, I invite you when you see a W.P.A. sign to look at the men. Now, when you see a bunch of men working on the road and loafing, don't blame me unless you see a sign there. I have had reports come in of men not working and when I arrived on the job found that it was a state public works crew. So, give us a little consideration. We put a sign up where we are working on a project; we are not ashamed of our work. We put up a big red, white, and blue sign.

If you should see some men who are not working, use your own judgment and see whether or not they are waiting for material which has been delayed. Rather than close the job down, we sometimes let the men wait an hour or so until the material arrives. That has happened repeatedly, but not as much now as in the past.

I have heard a lot of people say, "W.P.A. is good in this town, but you ought to see it in Pennsylvania or Ohio." I was at the Lake Placid Club recently and I heard William Starr Meyers, Professor of Political Philosophy in Princeton University, who taught my son what he knows about politics, which is not very much, and the title of his address was "What Happens to Your Dollar?" Now, this is in the heart of New York State and he said, "Let me tell you what is happening to your dollar in Ohio. They

are counting the graves in Ohio and they are counting the trees in Ohio." Maybe they were counting the trees; they counted the trees in Albany, but they counted them with city money years ago to find out how many poplars there were, and the city cut them down. They are counting the graves because they are marking them for the American Legion. But William Starr Meyers sits back in his chair of political philosophy in the ivory towers of Princeton and discusses something he knows nothing about. In order to know anything about the value of the W.P.A., you must have some experience with it.

I have a very good friend, a noted engineer in Baltimore, who has written a book about W.P.A. projects in Albany, and especially about the hundred million gallon reservoir completed in a shorter period of time than a private contract right alongside for the same size reservoir, and completed at a lower cost, excluding the one winter when we had to pay men whether they worked or not. The first winter of W.P.A., men were up there taking trees out when they should not have been working, but outside of that the work was completed at less cost than the private contract. And, we had no trouble with it because we insisted upon adequate supervision. The private contractor in his tunnel had a collapse because he thought he could run a tunnel himself. W.P.A. knew they could not run a tunnel because they did not know anything about it, and they insisted that the city provide a tunnel expert or otherwise they would not do anything. They sent to Washington and got a tunnel expert and they paid him by the foot and at the end we were a quarter of an inch out, while the private contractor was off eight inches.

This is the reason I say constant supervision is necessary and supervision beyond the part of the public official, because this job is your job if you have it done. It is not a W.P.A. job; it is the job of the city for which the work is being done.

The Value of the Works Program to Local Units

At times we talk about the sponsor's contribution. We don't talk about that in New York State; we talk of the federal contribution to the sponsor, and we are doing some real constructive jobs. For instance, the city put $250,000 into this reservoir in Albany. We made a test to see how much it would have cost the city to carry these persons on home relief and it was estimated at $225,000, so for an

additional $25,000 the city got a much needed reservoir. I don't believe there is a man in this room who would not accept the proposition of my building him a ten-thousand-dollar house for twenty-five hundred dollars, provided that he could watch the building of that house and when necessary say that the house is not being built according to specifications, and that he wants it stopped. This is your privilege under the Works Progress projects. You are getting something for nothing.

In this state, for twenty-five or thirty per cent of the cost, you are getting real constructive work and we have, with a few exceptions, real constructive jobs. When you see a job that is not constructive, remember it is not ours but yours, the job which the city has given to us. Three years ago I heard a mayor make a number of critical remarks about the W.P.A. He stated that it would not be so bad if they did some really decent jobs, and so I took over to him all of the projects in which we were engaged, and showed him where he had signed every one. Needless to say, he stopped talking about the W.P.A. We always get the blame when we take a poor job, but you are the ones who give it to us. You put your money into it. Your money is in there just as much as the federal funds, and you are responsible to see that W.P.A. gets the proper jobs and to see that the work is properly done. If it is not done, tell the W.P.A., and if the W.P.A. does not correct the condition, then go out and holler to the high heavens how poor it is. However, if they do correct the condition and build the job to your satisfaction, we don't ask you to tell anybody about it. We don't even want you to say that it is a fine job. All we want you to do is not to say the W.P.A. is terrible.

Emergency Activities

I was out on Long Island yesterday where they felt the effects of the hurricane, where houses were taken off the sand dunes, houses costing seventy-five to three hundred thousand dollars, and carried across the bay, landing on the streets of the village of Westhampton, completely blocking them. A week ago we got a call to go out there. There were no if's or and's about it. The W.P.A. immediately moved in and cleaned the job up. Yesterday I was talking to two men, both of them wealthy and very prominent in this state, and one man said to me, "Mr. Herzog, if you had asked me two weeks ago what I thought about the W.P.A. I

would have told you that I thought you ought to wipe it out as quickly as you can, but I am changing my mind. I believe that there is room for a permanent organization of this character, possibly not just exactly W.P.A., possibly not as big as W.P.A., but some governmental organization that can move in disasters of this kind." We moved a thousand men in there over night. We hired a train and brought our own water in and did everything to assist that town and build up the morale of those people. They thought they were completely ruined but in two days the streets were opened up and in a week's time every street in the village had been opened. There is still work to be done by us, but we will release the men as fast as we possibly can. The town was under martial law; that is how bad it was.

You will no doubt recall the floods in the west, in New England, Rhode Island, and the hurricane in Key West. You can imagine what would have happened if we had not had an organization of this character—an organization that was mobile and had imagination enough and nerve enough to go out and cut red tape.

Another of these men I spoke with yesterday said, "I called a certain organization in Washington and told them what we were up against and asked for help, and they told me they would send some men up to look the situation over to see how bad it was and that it might be necessary to start a drive for funds." Well, W.P.A. did not start any drive for funds; they did it. They did not ask permission of Mr. Hopkins or the Congress or Mr. Roosevelt. They knew that the permission was there. They went in and did the job and then Mr. Hopkins, who was in the west, came back immediately and wired us to go ahead and do everything we could. We knew we had a man with nerve at the head of our organization who would permit us to do things which ordinarily could not be done.

Possibly I have not followed the subject as given to me, but I did want to impress upon you gentlemen from all over the country at least what we in New York are doing. I don't know what you are doing in the other states because I am not familiar with it. However, I do know most of the administrators and I believe a majority of them are trying to do what we are doing in this state.

J. EUGENE ROOT
Director of Public Works, Cincinnati, O.

MR. FELLOWS' paper was an appraisal of W.P.A. Well, permit me now to appraise it also by simply the curt statement that the only difference between a stepping-stone and a stumbling-block is the way in which it is used.

By way of contrast now, I want to give you just one or two little examples. First, I shall refer to the flood in Ohio in January, 1937. W.P.A. jumped in and helped us along as the water was rising and continued to help us until it got back into the stream. Then when it came to the clean-up program, in order to get about two thousand men we were asked to divide the city into about thirty districts, and to establish in each district an office with all of the necessary furniture, telephone, light, and heat, etc., for their office men before they would agree to start registering anyone for work on the clean-up program.

Back in 1933 we got three million or more men working on good projects with little or no red tape, we may say, but now due to the educated way in which W.P.A. operates, it is quite necessary that many preliminary things be done before they start a job. In other words, we have a job schedule now which says that we are to have so many men per day or per week throughout the life of the job.

W.P.A. is doing some commendable work and I would say that about ninety-nine per cent of all cooperative work between Cincinnati and W.P.A. has been worth-while work. The City of Cincinnati, I must say, has been very favorably benefited in the last five years, throughout this entire program.

Newly Discovered Facts about Our Highway System

H. S. Fairbank

Chief, Division of Information, U. S. Bureau of Public Roads

Ever since the League of American Wheelmen won its first converts to the cause of "good roads" in the early 90's, there has been a common tendency to regard the problem of the highways too simply. Seen from the restricted viewpoint of the average observer, a limited aspect of the problem often appears as the whole; and ideas conceived from such a partial view have continuously embarrassed and retarded the evolution of a consistent national policy for dealing with the problem in its entirety.

In the early years of the century there were many people who believed, with D. Ward King of Missouri, that a solution of the problem was no more difficult than the faithful use of a split log drag after every rain.

Later the surfacing of roads claimed the largest measure of attention; and what had been a united band of apostles split and proliferated into sects, each firmly assured that there could be no Way but one, and that surfaced with the pavement of its particular preference.

There were in those days also many who felt that there was really nothing to the road-building problem except the single question of whether "to bond" or "pay-as-you-go," and who were convinced that with a proper answer to that question the rest would be easy.

And it was in those days, too, that we heard the first mutterings of the controversy between the advocates of intercity and farm-to-market roads—two limited-vision groups that today include as their extremist elements those, on the one hand, who would have us do nothing until we have all-weather surfaced every mile of road traveled by a rural free delivery carrier and, on the other, those who insist that we drop everything else and build a number of transcontinental superhighways, straight as a string and uniformly broad in every section.

Divergent partial views of the highway problem account for the conflict of claims of state, county, and city governments in the apportionment of motor vehicle revenue. It is a partial view that

convinces worried legislators that the improvement of roads is so far advanced that they may safely divert to other purposes large sums of the highway's own earned revenue. Other such partial views are responsible for the warring opinions currently advanced about the regulation and taxation of motor trucks; and still another for the belief—widely held today—that the existing road system is almost a total loss because of a short-sighted failure of highway engineers to provide in its creation against the generation of various kinds of traffic friction.

A variety of conditions determined the form of the existing highway improvements and these account for such as there is of present inadequacy: conditions of limited available revenue and widespread, urgent need; of the unrevealed potentiality of the motor vehicle; of the fixity of long-life roads and the changing requirements of short-life motor cars; of the sanctity of property lines and impediments, legal, selfish, and financial, to new right-of-way acquisition. A knowledge of all these conditions explains most of the present inadequacies of the improved highways and relieves the highway engineer of the charge of uncommon shortsightedness.

Yet, it is true that highway officials also have viewed their job partially rather than as a whole. An understandable early preoccupation with physical problems, associated with the design and materials of roads and their construction and maintenance, has tended to become a habit, causing roadbuilders in some instances to lose sight of the ultimate economic and social purposes of their road building. They have tended to regard the building of roads as an end in itself and not, as it really is, a means toward the facilitation of highway transportation, which, in turn, is only a part of the general system of transportation. By reason of official attachment their attention has been centered upon the roads or streets under the administration of a particular political subdivision or government agency and, not unnaturally, they have sometimes acted as if the portion of the highway system under their care were in fact the whole highway system.

System as a Whole Must Be Considered

Preferential attention accorded the main highways, included in the state and federal-aid systems, has been and remains a sound policy. While large sections of these systems remained without even a pioneer improvement it was unnecessary to look elsewhere

for the most useful expenditure of road revenues; and an exclusive concentration of the principal thought and effort upon them resulted in no important error. However, as we approach a reasonably satisfactory state of the main roads, the necessity grows to think of them as the parts of the whole highway system that they actually are, and the need increases to formulate new policies comprehending a balanced development of the whole system and all its parts, both rural and urban.

It is due to a perception of these important changes in the highway situation and to a recognition of the need of a more secure factual basis upon which to found the new policies that state-wide highway planning surveys, suggested by the Bureau of Public Roads, have been undertaken by the highway departments of forty-six States. In various stages of progress, these surveys are now under way in all states except New York and Delaware.

The scope of the surveys covers the entire rural highway system. For the first time an accurate inventory is being taken of all roads —recording the length and condition of all sections, and all significant roadside culture, including houses, churches, schools, stores, hotels, factories, mills, mines, quarries—everything, in fact that is associated with the origination and destination of highway traffic. For the first time also an effort is being made to estimate the flow of traffic over all rural roads and to determine the relative usage of the main and local roads, respectively, by urban and rural residents, and by what may be described, respectively, as local, and general or through traffic.

The inventory is extended into cities to cover only the condition of the streets that serve as cross connections of the principal rural highways, and to record the number of, and conditions existent at, all railroad grade crossings, completing in this respect the record previously taken at all *rural* grade crossings. The proportions of the task and the limited funds available have prohibited a complete inventory of city streets, and have prevented an actual count of traffic on the streets; but the immediate factual needs for general purposes are being supplied as fully as possible by an assembly of all available city maps and by an estimate of the total volume of city street usage, arrived at by sampling methods that have proved their reliability.

The financial studies, which, after the inventory and traffic determinations, constitute the third major department of the surveys,

cover both city street and rural road administration, and include a determination of all income collected and expenditure made for road and street purposes, the tax sources of the income, and the purposes of the expenditure. For relational purposes, the financial studies also seek to establish the total measure and classification of all tax income and expenditure for all public purposes, both urban and rural. Consideration of the street and highway figures in comparison with such totals will, it is hoped, assist the formation of a judgment of the relative adequacy or inadequacy of the highway finances.

First Findings of the Highway Surveys

Without attempting further to detail the complex, interrelated group of studies that compose the surveys, an idea of their usefulness may be given by a brief recital of some of the results that are now beginning to emerge and by reference to a few of the interesting facts and relations uncovered by early analyses of the field data.

[Mr. Fairbank illustrated the following section of his address with lantern slides of the various maps described. It is regretted that their size and detail make reproduction here impracticable.—Editor.]

One of the early results in most of the states is the production of the first really informative and reliable maps of the entire rural highway system. Drawn for each county to a scale of one inch or more to the mile, these maps show by uniform symbols the existing surface type of all roads, the location of all railroads, all navigable streams, all houses, churches, schools, and industrial establishments (also identified by uniform symbols) and a variety of other features important as information not only for highway planning but for most other public purposes, and for many of the purposes of private industry. A particularly interesting feature, to be found on no other maps, is the limits that have been drawn about the larger unincorporated urban communities. These limits have been determined, with the cooperation of the United States Census Bureau, in consideration of the actual aggregation of the population forming the community. They will be employed by the Bureau in the 1940 census for a first separate recording of the population in such communities. Faster than these maps can be completed the widespread realization of their usefulness grows, and the demand for copies is exceeding all anticipations.

Following closely the completion of these first General Highway and Transportation Maps, as they are called, another series of maps is being produced, to the same lineal scale, which will present a clear picture of the distribution and flow of traffic over the whole rural road system. These are the country's first complete highway traffic maps, and they permit a clear conception of the relative traffic use of all parts of the entire road system, particularly a comparison of the usage of the state and local highways, that it has not been possible previously to obtain. Besides the indication of traffic volume, these maps also show the surface type of the highways, the location of houses and other features of the first series, and so depict a number of relations important in highway planning, particularly (1) the existing state of road improvement in relation to that indicated as desirable by traffic volume, and (2) the volume of traffic in relation to the location of traffic sources, including rural homes and industries as well as urban communities.

As the county traffic maps discover to us the relative importance of all roads in the intimate sphere of the local community, so, in the larger sphere of the state, the state traffic maps are useful, in that they present a clear picture of the location of heaviest traffic burden within the main road system of the state. This is the type of traffic map made familiar by earlier traffic surveys. Viewed in the light of the far more extensive information produced by the current studies we see how limited are the concepts obtainable from the state maps; and we find much more interest in the first national traffic map which, tentatively, we have been able to construct from the still incomplete results of the planning surveys. Although it is subject to some correction of detail there is no doubt that this map presents a picture of the flow of traffic on the principal highways of the nation that is substantially correct in the relative sense. As customary, the open bands represent the total traffic, except that the humps that would otherwise appear at the cities have been deliberately shaved off. The black, interior bands represent, on the roads of each state, the portion of the traffic carrying the license tags of other states—the so-called foreign traffic—except that, again, we have cut off the small enlargements that would otherwise appear at each state line, where over-the-line local movements are numerous. The clear conception of the relative highway needs and relative traffic difficulties of the various sections of the United States, which this map for the first time affords, shows how unreasonable it is to

assume that any single type of provision or single solution will properly meet the situation existing in all states. By long odds the country's heaviest traffic is found in the Middle Atlantic and New England states. The traffic bands in these sections were so wide that they could not be crowded into the small-scale map. It was necessary to show them in the inset which is drawn to a lineal scale four times as great as that of the general map. But the width scale of the traffic bands is unchanged. Outside of this relatively small area of greatest traffic concentration the principal volumes are found in the East North Central states and on a few outstanding interstate routes elsewhere, particularly along the east and west coasts and two or three of the prominent east-west routes.

Road Building and Traffic Demand

That the response of the roadbuilders is reasonably consistent with the traffic demand is shown by the map which charts, as of January, 1938, the location of all existing four-lane highways and the further lines along which a similar type of improvement is likely to be needed in the near future, as estimated by state and federal highway officials. Note that the solid lines, indicating existing four-lane pavements, are most numerous and most nearly continuous in the Middle Atlantic and New England and East North Central areas where the traffic map shows the greatest traffic concentration; and note also how remarkably the judgment of the practical roadbuilders agrees with the indications of the traffic map in the matter of needed extensions of four-lane pavement, as shown by the dotted lines. For a full appreciation of the significance of this close agreement, it should be added that this traffic map was not available to the state and federal engineers and officials at the time they were called upon for their opinions.

Facts developed by the planning surveys show the extent to which the building of the wider roads has lagged behind the need for them. In ten representative states the surveys show, as detailed in the table, that the mileage of roads on which the average traffic is 4,000 vehicles a day or greater is 1,138. A daily average traffic of 4,000 vehicles is close to the maximum for which a two-lane pavement will suffice. On this basis, then, there should be in these ten states at present, 1,138 miles of the wider pavements, preferably four lanes wide or wider. On January 1, 1938, the mileage actually existing in these states, four lanes wide or wider, was 1,333.

Mileage of Rural Highways Carrying Annual Average 24-Hour Traffic of 1,000 or More Vehicles. Arranged by Traffic Volume Groups

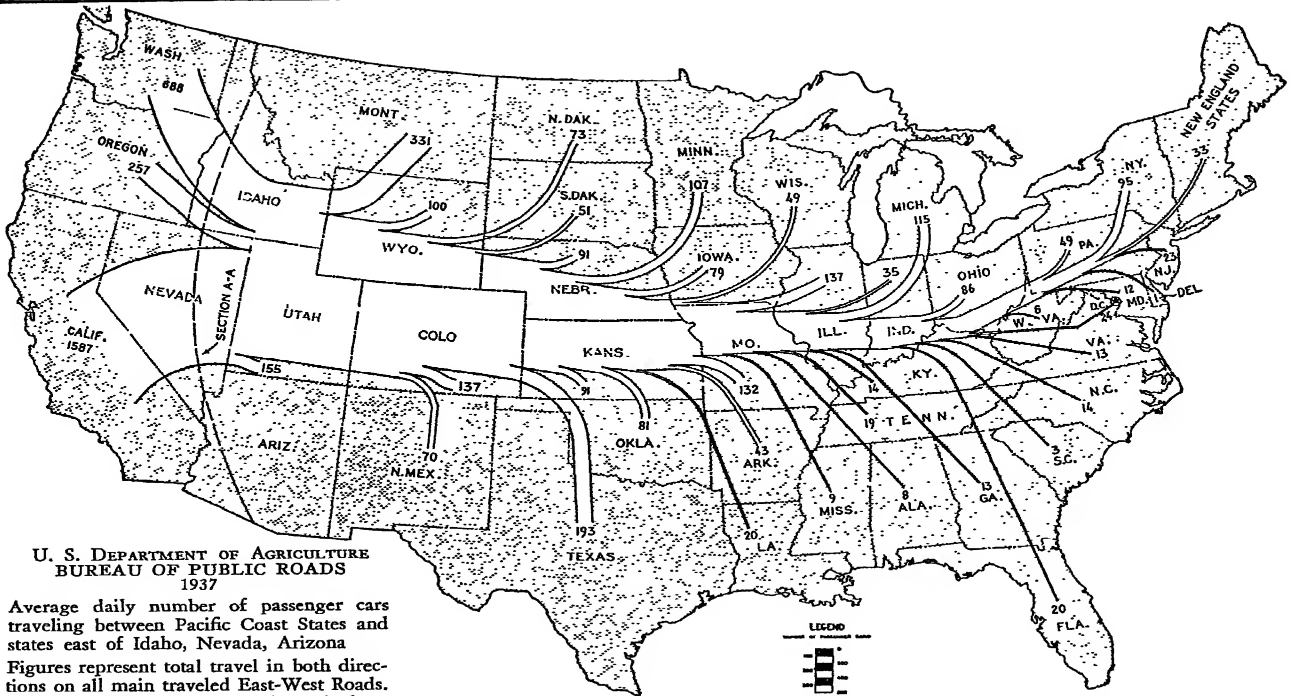
State	Annual Average 24-Hour Traffic: 1,000 to 1,499	1,500 to 1,999	2,000 to 2,999	3,000 to 3,999	4,000 to 4,999	5,000 to 9,999	10,000 and over	Total 1,000 and over	Total 2,000 and over	Total 4,000 and over	Total Mileage	Percent of Total Mileage with Total Traffic: 1,000 and over	2,000 and over	4,000 and over
MILEAGE, RURAL STATE HIGHWAYS														
Alabama	587.0	233.6	99.2	17.6	—	—	—	937.4	116.8	—	5,707	16.4	2.0	0.0
Florida	1,203.0	577.0	326.0	65.0	24.0	—	—	2,195.0	415.0	24.0	9,737	22.5	4.3	0.2
Illinois	1,941.9	1,156.7	800.2	157.8	98.8	87.5	3.0	4,245.9	1,147.3	189.3	10,342	41.1	11.1	1.8
Iowa	1,422.1	473.0	201.5	22.0	5.0	—	—	2,123.6	228.5	5.0	8,278	25.7	2.8	0.1
Kansas	649.4	390.1	232.4	61.7	12.2	3.5	—	1,349.3	309.8	15.7	9,103	14.8	3.4	0.2
Michigan	830.0	498.0	711.0	245.0	116.0	187.0	13.0	2,600.0	1,272.0	316.0	9,275	28.0	13.7	3.4
Missouri	1,105.0	675.0	364.0	151.0	41.0	74.0	12.0	2,422.0	642.0	127.0	14,458	16.8	4.4	0.9
Ohio	1,781.8	831.9	931.8	334.7	139.9	87.0	—	4,107.1	1,493.4	226.9	12,200	33.7	12.2	1.9
Virginia	1,000.2	470.1	371.5	86.5	7.1	80.6	6.5	2,022.5	552.2	94.2	8,239	24.6	6.7	1.1
Wisconsin	1,242.0	464.0	265.0	60.0	55.0	22.0	—	2,108.0	402.0	77.0	9,769	21.6	4.1	0.8
Total, Rural State Highways	11,762.4	5,769.4	4,302.6	1,201.3	499.0	541.6	34.5	24,110.8	6,579.0	1,075.1	97,108	24.8	6.8	1.1
MILEAGE, OTHER RURAL ROADS														
Alabama	26.2	9.4	5.6	—	2.4	0.5	—	44.1	8.5	2.9	55,180	0.1	0.0	0.0
Florida	—	—	—	—	—	—	—	—	—	—	20,717	0.0	0.0	0.0
Illinois	91.4	24.7	39.4	13.5	3.8	7.4	0.7	180.9	64.8	11.9	96,637	0.2	0.1	0.0
Iowa	—	—	0.6	0.4	—	—	—	1.0	1.0	—	94,354	0.0	0.0	0.0
Kansas	8.7	2.1	1.3	—	0.5	—	—	12.6	1.8	0.5	122,044	0.0	0.0	0.0
Michigan	188.0	85.0	71.0	19.0	1.0	9.0	—	373.0	100.0	10.0	83,317	0.5	0.1	0.0
Missouri	8.0	3.0	10.0	4.0	10.0	16.0	6.0	57.0	46.0	32.0	102,371	0.1	0.0	0.0
Ohio	69.8	18.7	0.8	1.5	6.0	—	—	96.8	8.3	6.0	73,506	0.1	0.0	0.0
Virginia	200.0	124.0	48.0	28.0	—	—	—	400.0	76.0	—	38,447	1.0	0.2	0.0
Wisconsin	56.0	11.0	29.0	2.0	—	—	—	98.0	31.0	—	76,299	0.1	0.0	0.0
Total, Other Rural Roads	648.1	277.9	205.7	68.4	23.7	32.9	6.7	1,263.4	337.4	63.3	762,872	0.2	0.0	0.0
MILEAGE, ENTIRE RURAL HIGHWAY SYSTEM														
Alabama	613.2	243.0	104.8	17.6	2.4	0.5	—	981.5	125.3	2.9	60,887	1.6	0.2	0.0
Florida	1,203.0	577.0	326.0	65.0	24.0	—	—	2,195.0	415.0	24.0	30,454	7.2	1.4	0.1
Illinois	2,033.3	1,181.4	839.6	171.3	102.6	94.9	3.7	4,426.8	1,212.1	201.2	106,979	4.1	1.1	0.2
Iowa	1,422.1	473.0	202.1	22.4	5.0	—	—	2,124.6	229.5	5.0	102,632	2.1	0.2	0.0
Kansas	658.1	392.2	233.7	61.7	12.7	3.5	—	1,361.9	311.6	16.2	131,147	1.0	0.2	0.0
Michigan	1,018.0	583.0	782.0	264.0	117.0	196.0	13.0	2,973.0	1,372.0	326.0	92,592	3.2	1.5	0.4
Missouri	1,113.0	678.0	374.0	155.0	51.0	90.0	18.0	2,479.0	688.0	159.0	116,829	2.1	0.6	0.1
Ohio	1,851.6	850.6	932.6	336.2	145.9	87.0	—	4,203.9	1,501.7	232.9	85,706	4.9	1.7	0.3
Virginia	1,200.2	594.1	419.5	114.5	7.1	80.6	6.5	2,422.5	628.2	94.2	46,686	5.2	1.3	0.2
Wisconsin	1,298.0	475.0	294.0	62.0	55.0	22.0	—	2,206.0	433.0	77.0	86,068	2.6	0.5	0.1
Total, Entire Rural Highway System	12,410.5	6,047.3	4,508.3	1,269.7	522.7	574.5	41.2	25,374.2	6,916.4	1,138.4	859,980	2.9	0.8	0.1

In the ten states the total mileage of all rural highways is about 28 per cent of the national total. If, therefore, traffic in these states may be assumed to be fairly representative, it is reasonable to estimate that the roads in all states now serving 4,000 or more vehicles daily and, by that test, now requiring pavements four lanes wide or wider, total about 4,000 miles. The mileage of pavement of such width actually existing on January 1 last was 3,452. By the test applied, it is apparent that there is some present deficiency, and the actual deficiency is more substantial than the simple mileage figures indicate, because a very considerable part of the existing multiple-lane mileage is improved with undivided pavements, which experience has shown to be definitely unsatisfactory.

It has been estimated that present traffic will be approximately doubled by 1960. Incomplete studies, made as part of the planning surveys, indicate that this estimate is generous. If it be assumed to be correct, then it may be supposed that the mileage of roads now carrying 2,000 or more vehicles daily will, by 1960, be serving at least the 4,000-vehicle volume indicative of the need of four-lane improvement. As shown by the table, the mileage in the ten states represented on which the traffic volume is now 2,000 or more vehicles daily is 6,916, indicating the probability of a national total of about 25,000 miles. On the basis of these figures it seems evident that construction of divided multiple-lane highways must proceed during the next 22 years, in the country as a whole, at an average rate in excess of 1,000 miles per year.

With less than 3 per cent of the roads in these representative states now serving 1,000 or more vehicles daily and less than 1 per cent serving 2,000 vehicles or more, it is clear that two lanes will long remain the standard of pavement width for the vast majority of the rural roads of the country.

One fact more should be mentioned before we leave this very informative table. That is the striking evidence it furnishes that the roads comprising the state highway systems of these ten states have been well chosen. Of their total of 859,980 miles of rural roads only 25,374 miles carry a traffic averaging 1,000 vehicles a day or more, and 24,111 of these miles are in the state highway systems. In the entire group of states, as the table shows, only a fifth of 1 per cent of the *local road* mileage carries traffic that averages as much as 1,000 vehicles daily; and only in Virginia does this percentage rise to as much as 1 per cent.



U. S. Department of Agriculture
BUREAU OF PUBLIC ROADS
1937

Average daily number of passenger cars traveling between Pacific Coast States and states east of Idaho, Nevada, Arizona

Figures represent total travel in both directions on all main traveled East-West Roads. Stations of observation were located along Line A-A

In Figure 1 we have graphed the results of some early analyses of the planning survey data that bear upon the current discussion of the need for construction of a system of transcontinental superhighways. At the curved line, marked Section A-A, that extends longitudinally through the states of Idaho, Nevada, and Arizona, the width of the trunk of the tentacled band represents the average daily number of all passenger cars passing eastward and westward on trips extending beyond the borders of the three states, on all major east-west highways, from the Canadian line to the Mexican border. The total traffic of passenger cars on all these highways, as represented, was found to be 2,532 vehicles daily.

The tentacles show the states to and from which these 2,532 daily passenger cars are bound; and the width of each tentacle represents the number headed toward or coming from each state. All, of course, are going to or from Washington, Oregon, or California, since to the west of the curved line there are no other states. Eastward the band breaks down rapidly and at the Mississippi River has shrunk to a third of its original width. At the eastern seaboard it is a few thin threads, the combined width of which represents just 300 vehicles. That is the measure of the total daily transcontinental passenger car traffic on all major east-west roads in the country—just 300 vehicles. When we think of providing accommodation for transcontinental traffic we can know now very accurately what we are proposing to provide for. It is 300 vehicles a day.

That does not mean, of course, that the passenger car traffic on all our great east-west transcontinental highways, either those we now have or those we may later construct, will at any point be limited to 300 daily vehicles. It means that the traffic going all the way would be limited to that number but the traffic on the roads at any longitudinal section that we might draw would be considerably greater. The point is that this considerably larger traffic would consist at all sections mainly of traffic making much less than transcontinental trips. In other words it would be at all points a much more local traffic, a traffic that would swell and shrink locally, influenced mainly by the location and size of cities.

How short the scope of movement on the rural highways actually is, can be seen from Figure 2, which shows, graphically, the range of frequency distribution of the length of all one-way passenger car trips extending outside of cities in 11 typical states. The shaded portions of the bands cover the ranges between the maximum

and minimum percentages of the total traffic that compose the various trip-length groups. The graph shows that in one of these 11 states 43.8 per cent of all one-way highway trips extending beyond city limits were trips of less than five miles. In another state the percentage of this shortest class of trips was only 25.7. In all the

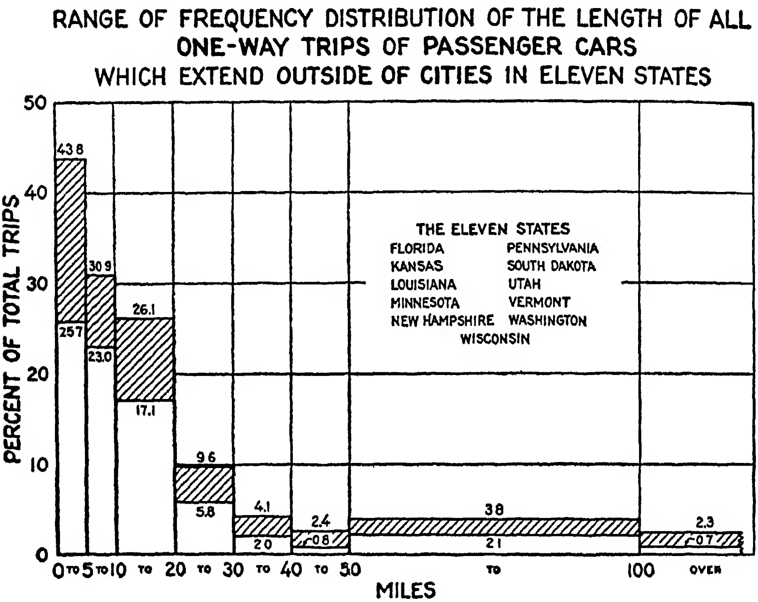
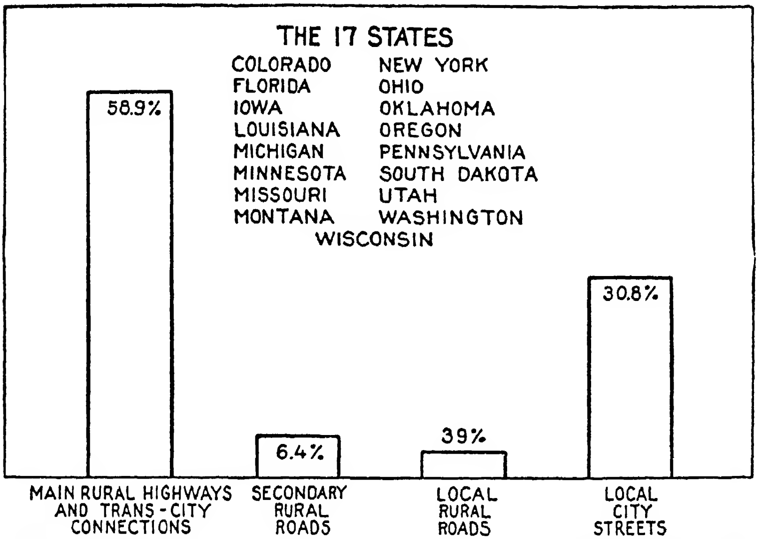


FIGURE 2

other states the percentage was somewhere between those limits. Similarly, the limits of the five-to-ten mile percentages are 30.9 per cent maximum, and 23.0 per cent minimum. It is evident that 30 miles is long enough to span the great majority of all trips extending outside of cities in these states. The percentage of trips over 50 miles in length is extremely small; over 100 miles a bare 1 or 2 per cent. Let me repeat that these figures relate to *all* one-way trips extending beyond city limits, on *all* classes of roads, main and local. If all the intra-city trips were included the average ranges would be greatly shortened. If only trips on the main highways were considered the ranges would be lengthened.

It appears from this evidence, collected by the planning surveys, that most highway movements are very short movements. The

surveys also tell us something very definitely about the classes of highways on which these movements occur. These facts are shown in Figure 3 as obtained in 17 states. In these states it is found that 58.9 per cent of the total annual motor vehicle travel on all roads and streets occurs on the main rural highways and the streets that con-



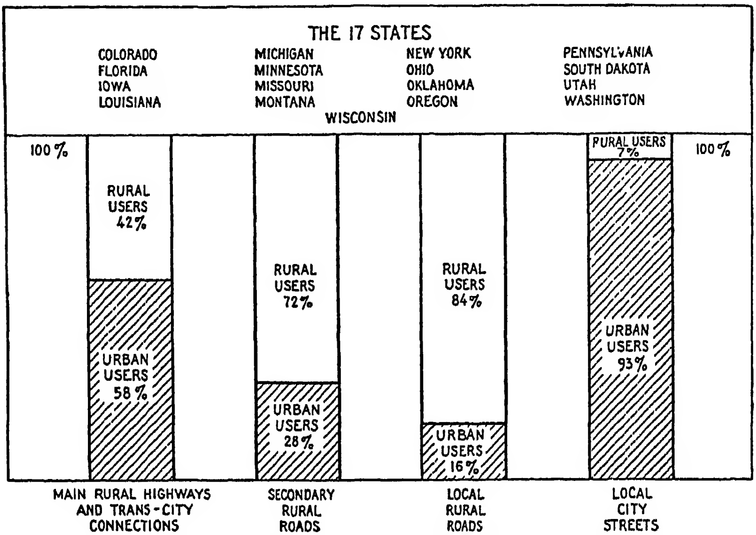
DISTRIBUTION OF TOTAL ANNUAL MOTOR VEHICLE TRAVEL IN 17 STATES ACCORDING TO THE CLASSES OF HIGHWAYS BY WHICH IT IS SERVED

FIGURE 3

nect them across cities. Of the balance of the total movement, the greater part—30.8 per cent of the total—occurs on the large mileage of other city streets, the local or neighborhood streets; and scarcely more than 10 per cent of the total occurs on all the secondary and local rural roads, which, in mileage, have eight times the extent of the group of main highways.

Having thus shown where, or on what classes of roads the traffic movement occurs, the facts of the planning surveys go further to show who engages in these movements. They show, for example, that urban and rural users, respectively, are found in different proportions on the several classes of roads. These further facts are shown in Figure 4 for the same 17 states. From this graph it will be seen that the main rural highways and their trans-city connections are really everybody's highways. Forty-two per cent of their use is

by rural motor vehicle owners; 58 per cent is by urban owners. In these 17 states the population, at the time of the last census, was 38 per cent rural, 62 per cent urban. It is apparent that country and city people meet on these main arteries in just about the proportion of their relative numbers in the total population. The bar representing the "local city streets" shows a quite different situation. Ninety-



PROPORTIONS OF URBAN AND RURAL USERS OF EACH CLASS OF HIGHWAYS IN 17 STATES

FIGURE 4

three per cent of the use of these neighborhood streets is shown to be by urban vehicles; only 7 per cent is by rural vehicles. These lesser city streets, in other words, unlike the main rural highways and the principal cross-connecting streets, are not proportionally useful to all classes of the population, but, on the contrary, are of service mainly to city people. And a situation almost the reverse of this is seen to exist on the local rural roads, on which the pertinent bar of the diagram shows that 84 per cent of what has previously been shown to be a small total usage, is by rural vehicles and only 16 per cent by urban vehicles.

Facts Should Be Basis of Action

In citing these few newly discovered facts about our highway

scope and variety of the information now fast coming to light as the result of the highway planning surveys in forty-six states. The purpose of the surveys is to unearth facts; but I should like to stress the thought that there is no virtue in the facts themselves to build a mile of highway or evolve a single policy.

If the planning surveys are to yield the great benefits of which they are capable the facts they develop must be studied and used for the basis of action in planning the policies and performances of the future road program. This is a responsibility that lies first and most heavily upon the legislatures and upon responsible highway administrative officials. But in part it lies also upon the general public and upon such associations as this of persons especially qualified to understand and aid by their advice and support in the solution of the complex problems involved.

The initial planning surveys in some states are approaching completion. The first reports will shortly be issued. But we are not finished with highway fact finding. There will be continuing need to revise the various classes of data initially collected to keep them currently useful with the passage of time. Maps, correct as of the present time, will have to be revised to preserve their value. Traffic volumes change and the initial counts will quickly lose their validity unless they are regularly revised. In the case of some of the classes of data, now compiled for the first time, their full usefulness will mature only after much further extension of the record. Many of the basic determinations of the initial surveys will be refined and rendered increasingly accurate and useful by the gradual revision and accretion that will result from continuous further study over a period of years. In the absence of such continuing effort the initial survey data will become rapidly out of date, and their usefulness will depreciate. For these reasons the Bureau of Public Roads has urged all state highway departments to make provision for the incorporation of a permanent fact-finding division in their departmental organizations. The federal appropriations make provision for the financing of such fact-finding operations; and the Bureau has announced its purpose increasingly to require such facts, as only a continuance of the surveys can supply, as a basis for its approval of plans and programs submitted to it in the future.

It is the view of the Bureau that only through such factual guidance can we assure a scientific and businesslike administration of the complex and difficult job of operating the modern system of highway transportation; and it will use all its influence to convince

its cooperators, the state highway departments, of the necessity of continued study.

DISCUSSION

Alfred E. Roche

Formerly Director of Public Works, Troy, N. Y.

Mr. Fairbank's paper discloses an important service the federal government is rendering to the states and their subdivisions in surveying and inventorying the rural roads of the country. The early part of the paper tells us the work is divided into three major classes: first, the mapping of surveys and field data of the rural roads; second, the inventorying of structures and natural resources flanking the roads, as well as compiling the traffic data systematically; third, the assembling of data for a financial determination as to the sources from which highway moneys are derived and the use to which they are put, with a final theme in mind as to the adequacy or inadequacy of our financial highway policy.

The cities are materially interested in this work of the federal government because the density of traffic and expensive types of highway construction are encountered close to the city where, heretofore, insufficient street planning and studies were made to accommodate the traffic of the times. The cities are even more interested at this time in the financial policy of the large units of government toward a return to the city of some moneys which they have derived from the so-called automobile tax.

What I say refers to the State of New York. The policy of the state in withholding from the cities moneys collected from the so-called automobile tax has become highly controversial. It has been the subject of many legislative enactments during the past five years. As you know, the cities have supported measures seeking a return of part of the motor fuel tax so that they could use it for street improvements.

The services performed by municipal government affect intimately all individuals throughout their entire lives. Local government provides education; protects health; and provides a well regulated street system for the interchange of local and through traffic. It must also provide police protection; garbage-ash collection and dis-

posal; sanitation services; water supply; fire protection; home relief; and many other complicated and essential services.

It is important that all of these services be continued in a well regulated manner to maintain the health and well-being of the citizens. To do so requires that financial aid be given to cities for specific purposes. It is believed the aid should come from the specific sources from which the funds are derived.

Since the advent of the automobile and the modern highway, cities have increased in area, population, valuation, and taxation. Municipal activities unconceived of twenty-five years ago are now pressing, because of the change the automobile has brought about in our economic life. The automobile has created a demand on the part of the people for safe recreation other than on public streets; it has spread out the population of cities, thereby adding considerable mileage to the present street systems, and to the cost of pavements. It has revolutionized street cleaning methods and added to their costs. It has required an expensive traffic control system, and has created an equally expensive snow removal problem.

Where Is the Money to Come From?

Between 1880 and 1905 the trend of the municipal budget was slowly upward; after 1905 the trend was still upward but at an accelerated rate. The wide advance in the cost of conducting municipal government has been contemporary with the automobile, just as the highway has been. As a result of our acceptance of and accommodation to modern development, there is created a demand for more and new services of local government. The resulting increase in service has caused an increase in taxes.

The difficulty in paying taxes during a period of greatly reduced incomes has focused attention on the problems of municipal government. The excellent work related by Mr. Fairbank on surveys, fact finding, and inventories, is advancing in an orderly manner; but the financial policy for continuity of improvements is not made clear. It is recognized, of course, that physical facts must be assembled before a financial policy can be set up. Therefore, it is suggested that cities begin to assemble facts to warrant a financial policy helpful to them.

The cities have the burden of many added functions of government, with few new sources of revenue. Municipal activities have been multiplied during the past twenty-five years, old and

well established governmental functions have been enlarged. As a result, increase in the cost of local government has been inevitable. The bulk of moneys for supporting municipal activities came from but one source—namely, taxes on real estate. However, real estate can no longer carry the burden, and municipalities have no other source of revenue to continue fulfilling the demand for extended highway improvements. Therefore, they must seek a new source of revenue, or become stagnant.

Many city officials in New York State believe the taxes collected from motor vehicles to be fair, just, and equitable, and recommend that these taxes be continued as a source of revenue.

They know the money contributed to the state by motor vehicle users comes largely from the people dwelling within the cities. They believe 60 per cent of all of the motor vehicle moneys are derived from city dwellers. They likewise believe the funds collected by the state from this source should be divided with the city. There is no distribution to the cities now. The statistics which follow have been

NUMBER MOTOR VEHICLES REGISTERED

1937	2,640,675	1933	2,264,304
1936	2,525,199	1932	2,341,287
1935	2,395,144	1931	2,347,011
1934	2,283,269	1930	2,298,985

STATE AID TO TOWNS AND COUNTIES FOR HIGHWAY PURPOSES

Year	To Towns	To Counties	For Snow Removal
1937	$2,640,675	$1,915,000	365,000
1936	2,525,199	1,600,000	400,000
1935	3,000,000	2,012,000	492,000
1934	3,000,000	2,000,000	300,000
1933	3,543,750		300,000
1932	4,113,600	2,121,200	200,000
1931	4,018,893	2,121,418	455,000
1930	3,446,858	2,104,240	300,000

DISTRIBUTION OF MOTOR AND GASOLINE TAX MONEYS

	Motor Tax Refunds		Gasoline Tax Refunds		
Year	To New York City	To 57 Counties	To New York City	To 57 Counties	Motor Vehicle Fee and Tax Money Retained by State
1937	$5,043,165	$7,640,073	$1,715,081	$6,860,327	$91,560,115
1936	4,449,962	6,704,633	1,580,770	6,323,081	81,389,081
1935	4,205,747	6,277,355	1,520,803	6,083,212	80,313,410
1934	4,065,126	4,096,795	1,454,846	5,817,946	65,927,867
1933	3,794,930	5,570,207	1,469,126	5,876,505	66,853,091
1932	4,049,239	6,022,411	1,553,522	6,214,090	54,687,248
1931	4,047,369	6,194,303	1,432,525	5,730,102	54,071,454
1930	3,549,402	5,686,226	1,099,053	4,396,212	49,181,950

secured from the State Comptroller and the State Department of Taxation. They illustrate the necessity, in New York State, of planning a financial policy equitable to the city.

Strange as it may seem, it is true the cities received no return of motor vehicle moneys, although the cost of municipal government has doubled since the advent of the automobile, as has the cost of construction of highways and streets for traffic accommodation.

Following is a list of ordinary classes of work performed by a public works department which are directly identified with the automobile and highway. The figures are a compilation of the operating budgets of 23 cities in the state.

	Per Capita Cost	
Street cleaning	$0.82	
Street lighting	1.22	
Street repair	0.69	
Street drainage	0.34	
Snow removal	0.08	
Sanding icy streets	0.03	
Signal control	0.03	
Traffic regulation	0.54	
Remodeling bridges	0.08	
Playground cost (to keep children off the streets)	0.33	
Amortization of pavement debt	0.38	
Interest on pavement debt	0.04	
Administration (1/10 per capita cost of executive and legislative branches of government)	0.12	
TOTAL		$4.69
An examination of municipal accounts of 1908, of the same 23 cities referred to above, reveals the cost of services rendered in that year to be		1.64
The difference in cost directly traceable to the automobile and highway construction then is seen to be		$3.05 per capita

Our population is distributed somewhat as follows: residing in New York City are 7,000,000 people; in 58 smaller cities, 3,200,000 people; and in rural areas, 2,800,000 people.

There are 5,986 miles of pavement in cities exclusive of New York; 1,263 miles of arterial streets connecting highways; and 3,267 miles of unpaved streets.

A great expense has been incurred during the past twenty-five years in regulating, grading, curbing, draining, and paving streets in municipalities. The demand for those improvements comes from outside of the city hall. A tremendous debt was incurred for those purposes, for the benefit of the citizen automobilist.

Municipalities have fallen behind in the past ten years in not providing adequate maintenance for this extensive mileage of city streets. City budgets have been reduced in accordance with the public demand. There is also evidence of a lack of intensive, consistent, aggressive work on the part of our directing forces.

The necessity now exists for an extensive municipal street improvement program. Unfortunately, the municipalities are without the borrowing capacity to undertake the work demanded of them, and the miles of unpaved streets must forego improvement unless aid is given for this purpose.

Thus we come to the third major department of the surveys, which covers "city street and rural administration of highway funds." This survey is an attempt to determine what use was made of the street and highway dollar, all of which will be interesting. However, more to the point are the hopeful words of Mr. Fairbank on the financial aspect of governmental aid where he says: "Consideration of the street and highway figures in comparison with such totals will, it is hoped, assist the formation of a judgment of the relative adequacy or inadequacy of the highway finances."

Nathan L. Smith

Chief Engineer, State Roads Commission of Maryland

When the federal government first sponsored the idea of highway planning surveys, one of their hardest tasks was to overcome the feeling so well founded in the various highway departments that this was just another plan of Washington to tell them how to run their own business. In these states, where highway organizations had been functioning for many years, manned with personnel carefully trained in the selection, location, design, construction, and maintenance of roads and bridges, it seemed presumptuous for men of less experience to be brought in to duplicate studies already made, assemble resultant data, and then tell them which roads should be given priority in a betterment program.

And when, in Mr. Fairbank's paper, he notes how remarkably the judgment of the practical roadbuilders agrees with the indications of the traffic map in the matter of needed extensions of four-lane pavements, particularly in view of the fact that these maps were not available at the time the officials and engineers were called upon for their opinions, these officials and engineers will naturally be tempted to say "I told you so."

The majority of highway departments had for years been conducting traffic counts and using the resultant data as a basis for priority in the improvement of their arterial systems. They had kept maintenance records which showed very clearly when a narrow obsolete road was no longer able to carry the traffic to which it had become subjected. The results of the planning survey studies were merely a confirmation of their own decisions. What they really needed was the money to perform the indicated betterments.

But it is also true that some state officials have not been given a free rein in the selection of the routes on which they should expend their year's budget allotment. Political expediency has played an all too important part in the allocation of these funds, and this is particularly true where the arterial system has been completed and the state is ready to take up the improvement of secondary or tertiary routes. Hence it is a real help for the engineer to have the planning survey findings to back up his opinion.

A very important point brought out in the data now available is the preponderance of short-trip traffic. When we consider that, in the states used as an example, an average of about 35 per cent of the one-way trips recorded were movements of less than five miles, that around 27 per cent were from five to ten miles, and that trips of over 100 miles represented only 1 or 2 per cent, all counts being taken outside city limits, we should think twice before being carried away on the superhighway bandwagon so much advertised recently.

It is shown that the heaviest traffic in the country is in the New England and Middle Atlantic States, particularly along U. S. Route No. 1 and supplementary parallel routes. We have heard much talk of a through highway from Boston to Washington, by-passing all centers of population, free from intersecting traffic at grades, and embellished with all the clover leaves necessary to insure freedom of movement to the motorist. Yet, when the survey reports are published, I venture to say we will all be astonished at the small

number of persons operating vehicles along this main stem whose business or desire does not take him into New York or Philadelphia or Wilmington or Baltimore.

If there is any foundation for the estimate that the present traffic will be doubled by 1960, this expansion will doubtless require proportionately expanded types of highways; lanes for fast movements, lanes for slow movements, lanes for commercial operation, both freight and passenger, and provision for pedestrians. But the present need is for the accommodation of the short-trip operator; the man whose business is in the city but who prefers the healthy atmosphere of a suburban home, or the operators whose means of livelihood is the transportation of commodities between adjacent centers of population such as Wilmington and Philadelphia—26 miles apart. So let us keep our feet on the ground and accomplish the essential construction projects first.

In my opinion the real value in the planning survey reports will be found in the data concerning the less frequently traveled routes. I do not know the set-up in other states, but in Maryland the highway department acts as the agent of the various boards of county commissioners in the expenditure of secondary funds. With these commissioners up for election or reelection every four years, what is more natural than that they should want this money used on routes which will be of personal benefit? But with the Bureau of Public Roads allocating federal funds for secondary construction and requiring that these funds be locally matched, and with the routes on which this money shall be used subject to review and approval on the basis of data shown in the planning survey report, the state officials can control the situation more easily. Similarly the traffic and culture information will serve as a guide in determining the type and economic design which can be justified upon the route selected.

But, as Mr. Fairbank so truly states, this information must be kept up to date in order to be currently useful. The improvement of a rural road naturally will result in increased development and traffic, and the maps must be corrected to show these changes. This will require increased personnel and it is hoped that Uncle Sam will not forget that these men must be paid.

We do not know what additional studies will be provided for by the Bureau, but there is one thought I should like to bring into the record. There are two so-called by-products of highway trans-

portation—congestion and accidents. The former affects the time element, the latter the safety factor. Congestion causes mental turmoil, but accidents result in loss of life and limb. An analysis of traffic accidents, resulting in a definite program for correcting existing hazards and the prevention of the creation of new hazards, could well be given consideration by the planning survey.

In conclusion we should not let the new facts which are from time to time brought to light overshadow one fact that has been before us for the last few years. The operation of the planning survey is not a very costly undertaking, but the carrying out of the recommendations requires an outlay of many millions of dollars annually. These improvements should go on as rapidly as possible in order to keep pace with the growth of traffic. And, in order to see that this is accomplished, the financial findings of the survey should stress the need for putting a stop to the diversion of highway revenue so forcefully that the state legislatures will be compelled to subscribe to the slogan "Highway Revenue for Highway Uses Only."

Street and Road Design for Safety

D. Grant Mickle

Assistant Director, Michigan Highway Planning Survey

The fundamental requirements in the design of both urban and rural roadways are that their lateral dimensions shall be sufficient for the volumes of traffic to be served and that their longitudinal design shall be suitable for orderly movement at such speeds as the service demands.

Simple as the requirements appear to be, however, there is a wide variety in the relative emphasis given them under varying conditions. In ordinary urban centers, for instance, high concentrations of vehicles make capacity the principal criterion of roadway efficiency. On the other hand, the long distances between the origins and destinations of rural trunkline travel give a predominant importance to the factors governing speed. And where the area of urban concentration is widely extended or where the volume of trunkline traffic is abnormally high, careful adjustment of these

two requirements is necessary to deal adequately with the conditions of special hazard which are created.

Safety design is particularly concerned with the selection of means to attain this adjustment. It is not a separate specification added to the requirements for capacity and speed, but is part and parcel with them. It is merely a refinement of the methods for meeting these two basic requirements, and its aim is to provide facilities more perfectly adapted to their satisfaction.

Of course, it is dangerous to put too exclusive reliance on perfecting the physical plant in coping with highway accidents. It is a matter of common knowledge that most motorists can adjust themselves to driving safely under even the most unfavorable conditions of roadway and traffic. It is equally true that human frailty can and frequently does—momentarily, at least—offset and cancel all the expenditure of care and money which goes into the attempt to make highways safe. Reckless and careless driving are primary causes of traffic disaster, but at the same time better facilities will make recklessness less likely and carelessness less costly.

The present paper does not attempt to deal with the broad aspects of safety design. It is devoted very largely to the consideration of certain specific problems in urban and rural areas and in those twilight zones which lie around our cities but are not of them, and which are coming to be recognized as particularly promising fields for safety effort.

Urban Streets

As has been indicated, ample capacity is ordinarily the prime requisite of the streets and avenues of cities. Urban communities are very largely economic organizations and the movements of their traffic are controlled by the time schedules of business and industry. The fact that these schedules are thoroughly standardized results in huge surges of movement at set hours and, since these are the pulse beats of the city, they must be accommodated. But, when long distances are involved, as in the case of our larger cities, the time schedule also requires that the movement be rapid. To a great degree, it is the combination of these two conditions which creates the safety engineer's problem.

Street Capacity. Ample street capacity is a basic element in planning city streets for safety. Congested urban arteries are either

dangerous or inefficient and usually both. Safe design for large volumes of city traffic requires not only that individual arteries be capable of handling their load, but that the whole street system be adequate.

When the traffic engineer is confronted with a condition of overcrowding in a traffic way, it is unwise for him to jump too quickly to the conclusion that the remedy lies in a widening operation. Frequently it is found that a street which is loaded beyond its efficient or safe capacity, receives its excess traffic because other streets are inadequate or nonexistent.

A thorough study of the origins and destinations of vehicular traffic in the community will usually reveal the cause of and suggest the remedy for such conditions as these. This procedure is essential, because the widening of a single artery to accommodate movements which should go by other routes invariably results in an intensification of traffic disorder.

When a street is to be widened or a new street built, there are certain facts that should be kept in mind. Ten feet is apparently firmly established as the standard width for traffic lanes in urban communities. Since fractions of this width are of no value in moving vehicles, it should be strictly adhered to as the unit of traffic-way designs.

Two conditions may influence the over-all lateral dimensions of the city street. One is the presence of streetcar tracks and the other is the parking practice of the community. If tracks traverse the middle of the roadway, the space they occupy should be added to the width of the required number of traffic lanes. In determining the number of needed lanes, however, it should be remembered that a lane occupied by a streetcar track carries approximately half as much traffic as a clear lane.

Wherever parking at the curb is permitted, 7 feet must be allowed for a car parked parallel and not less than 13½ feet for a car parked at an angle with the curb. Consequently, when parking occurs on both sides of a street, from 14 to 27 feet must be added to the effective street width to provide for this use.

Consideration for the safety of pedestrians forbids that urban arteries be wider than the equivalent of two lanes for moving traffic in each direction unless safety islands are provided between the center area and the curb.

Elevated Streets. In those instances where other parallel arteries

cannot be added and widening of the overcrowded street is impossible or impracticable, provision of further capacity on an elevated roadway is sometimes resorted to. Such structures usually provide a free or limited traffic way without intersections at grade and with only a limited number of points of access and egress. Several types of hazard are thus eliminated. But while greater capacity and usually greater speed is achieved by this treatment, certain new problems of safety arise whose solution should find a place in the design.

The ramps which carry traffic onto and off the elevated structure are points at which conflict must be guarded against. There the entering or leaving vehicle is merged with or detached from a rapidly moving traffic stream. Lanes for acceleration and deceleration must be added to make this operation smooth and safe.

Usually these structures carry fast traffic moving in opposite directions and the problem of protecting these two streams from inter-conflict is a critical one. The heavy cost of providing additional width as well as space limitations will ordinarily rule out consideration of a divided roadway. Under these conditions, it would seem that a narrow traffic-dividing barrier to separate the opposing streams of vehicles is indicated. Experiments with such a device carried on within the last two years by the Michigan State Highway Department, and more recently in cooperation with the Yale Bureau for Street Traffic Research, show that it is perhaps applicable to such situations.

Intersection Design. While the elevated roadway obviates the problems arising from intersections at grade, the latter continue to exert a valve action on the traffic of surface streets. Regardless of the physical capacity of these arteries, their ability to carry traffic is strictly conditioned by the efficiency with which cross movements are handled. The platoonizing of main artery traffic which results from stop-and-go regulation at controlled intersections has its advantages. It creates intervals in the stream through which pedestrians can cross the roadway at other than controlled points. But where the intersection cross movement approaches the volume of the main artery, the efficient use of both streets is radically lessened.

Moreover, rapid movement through intersections is often adversely affected by the complicated maneuvers which occur within the main traffic stream. Some vehicles will turn to the right and others to the left, while the majority go straight through. Unless they have

been well organized before reaching the intersection, much dangerous and time-consuming confusion results. Added lateral roadway space is needed to organize properly traffic at these points, but usually it is just there that space is restricted by safety islands or loading platforms.

A considerable measure of relief can be secured under such conditions by widening the roadway and eliminating curb parking to a point well in advance of the loading platform, cutting back the corner, and encouraging selective channelization of traffic through the use of special lane markings.

At intersections where heavy volumes of through traffic cross, the grade-separating structure appears to be the only effective answer, particularly in congested sections where land values are high. In locations where conditions permit the use of sufficient space, traffic roundabouts and circles of adequate design and size are advantageous.

Parking Requirements. Indiscriminate parking at the curb creates hazards by reducing the usable roadway width, by the vehicle maneuvers attendant on parking, and by restricting the view of both motorists and pedestrians. Since industry for the most part provides off-street space for the cars of its employees, the curb-parking problem is largely centered in concentrated business areas and in certain residential districts.

Economic pressure is resulting in much serious study and considerable experiment with possible remedies for the situation existing in business sections. Traffic and commercial surveys have shown that transportation and parking difficulties build a rigid ceiling over the expansion of business in these areas.

Surveys in Detroit definitely established the fact that although its downtown section has ample off-street parking space for hire, there is an insistent demand by motorists for free service. This is obtained at the curbs with considerable disregard for legal regulations affecting time and location. It was also shown that there is a need for space to be used by short time parkers.

The most likely plan that has been suggested provides for strictly limiting and enforcing curb parking privileges, and the establishment of public parking lots close to the office and shopping section with shuttle bus connections to it. Curb parking would be limited to cars with the driver in attendance, though vehicles would be permitted to stop to unload or take on passengers.

The off-street parking spaces would be located on land occupied by deteriorated buildings verging on or actually having a slum character. A small fee would pay for car storage and bus transportation to and from the business section. The improvement in real estate conditions and values in the district should warrant a policy of assessing adjacent property to cover at least the cost of operation.

It is understood that Schenectady, New York, has adopted this program with the difference that parking meters have been installed in the area immediately beyond the business district.

While overnight street storage of cars in residential districts causes difficulties not unlike those created by day parking in commercial areas, the parking problem in home sections much more directly affects safety. Parking along both sides of narrow subdivision streets makes an ideal situation to trap children who dodge from between cars into the path of an approaching motorist. To assure that the motorist shall at least have some space to maneuver to safety, the absolute minimum width of streets on which parking may be expected should be 34 feet—two 10-foot traffic lanes and two 7-foot parking lanes.

The great volume of overnight parking in residential streets, especially in multiple dwelling neighborhoods, is a menace to real estate values and safety. Frequently partially developed districts already have their curb space almost completely utilized for this purpose with no, or completely inadequate, storage facilities in the buildings themselves. This practice handicaps or prevents both the effective use of public safety apparatus during the night hours and the future development of remaining vacant property.

Building ordinance provisions requiring the construction of storage facilities in some reasonable proportion to family units seem to be the only cure for this condition.

A few of the physical corrections and regulatory measures which can be used to improve safety on urban streets have been outlined in the foregoing paragraphs. Improved modern street lighting has also proved to be a sound investment in aiding the accident reduction program. The intelligent use of traffic control devices, such as traffic signals, signs and pavement markings, are likewise an aid to traffic congestion relief and accident reduction.

The first consideration that any city should give to its traffic and safety problem is the efficient use of its present facilities. Minor physical improvements often may be made to the methods of con-

trol or to the street system, which result in making the present facilities more safe and more efficient. In planning for future facilities, the basic facts concerning traffic movement should be carefully studied and taken into consideration in developing a traffic planning or street improvement program. If traffic control and enforcement are to be successful, all users of street space must be made aware of their responsibilities, one to another, and educated to the safe and efficient use of these facilities.

Rural Highways

The function of rural trunkline highways is to carry traffic between relatively widely separated points as rapidly as the nature of the service demands. As the traffic stream increases in volume and as its composition becomes more varied, the need for special measures to protect it from internal conflicts is greater.

The methods of attacking the problem of providing this protection are of many different kinds. Perhaps the most notable suggestions and developments have had to do with the type of highway, and many facts with regard to the design and construction of high standard limited-way trunklines have been brought to light. During the past year and a half the Michigan Highway Department, cooperating with the U. S. Bureau of Public Roads in a state-wide highway planning survey, has been investigating the limited but very important subjects of pavement usage and lane widths.

Since speed is the major requirement of travel on trunkline highways, it is essential to know what effect various rates of speed have on the usage of the pavements by the different classes of vehicles. Since the traffic stream contains various types of vehicles traveling at different rates of speed, it is essential to know what clearance distances are involved in actual overtaking and passing maneuvers. Since the larger vehicles are ordinarily the slower ones and so are involved more frequently in overtaking and passing maneuvers, it is desirable to know what effect these have on pavement use and traffic safety.

These three problems were the subject of special investigation and the facts which they revealed have resulted in changes in the standards of highway design in Michigan.

Vehicle Placement. The observations which were the basis for the study of vehicle placement were made on trunkline U.S.-10 between the cities of Pontiac and Flint. The highway is a modern 40-foot

that the department's standard for lane width shall be increased to 11 feet. Very serious consideration is also being given to the proposal to increase still further the width of the outside lane on curves.

Mixtures of Wide-Dimension Trucks. Closely related to these observations of vehicle placement and behavior in their implications as to safety design, were studies made of the relation between the proportion of large commercial vehicles in traffic to accident occurrence. The route studied was on the twin highways U.S.-24 and U.S.-25 between Detroit and Toledo which have the severest use of any route on the trunkline system. The annual average traffic amounts to 9,000 vehicles per day mostly traveling at high rates of speed, but with an admixture of heavy trucks which varies from 19 per cent in the daytime to over 50 per cent in the hours of heaviest commercial movement. The pavement is three and four lanes wide and undivided.

Analyses of the types of accidents, the hours of their occurrence, and of the variations of the percentages of large trucks to all traffic, gave startling evidence of the part these large-dimension vehicles play in traffic conflicts. It was indicated that their presence on the highway increased by 2.58 times the chance that another vehicle would have a collision. This was not the result of misbehavior on the part of the trucks, nor did it indicate that these vehicles were involved in accidents in this proportion. It demonstrated that the latter created conditions due to their size which, when combined with other fast moving traffic, definitely increased hazard.

These results give added weight to the belief that present standards and practice with regard to lane widths and pavement design must be subjected to a sharp upward revision. They also point to the need for further study of the problem of segregating widely differing types of traffic.

Multiple Lane and Divided Roadways. Since it is not likely that the near future will see any very considerable mileage of exclusive high speed and commercial highways, the problem of providing facilities which will permit the safe operation of the present highly heterogeneous traffic on the same highway continues to be of great importance.

While an increasingly preponderant majority of highway authorities are turning to divided roadways as the ultimate form for heavy traffic trunklines, the relative value and safety of undivided multi-lane pavements still demands much investigation. This is

particularly true of the three-lane pavement which has quite generally had a bad reputation.

A preliminary examination and analysis of accident records on Michigan two-lane, three-lane and four-lane undivided trunklines covering the past four years does not bear out the charge that the three-lane roadway is especially hazardous. As a matter of fact, the figures appear to indicate that, when careful alignment gives proper sight-distance, it is the safest of the three. On the basis of these studies it seems that this much debated type of highway serves a very useful purpose as a transitional form between the two-lane and the final divided four-lane design.

Experience with the divided roadway trunkline under conditions of increasing traffic volumes and speeds emphasizes the desirability of having a separating strip of adequate width. The protection it gives from headlight glare and conflict with vehicles thrown from the opposing lane by collisions as well as its service in aiding crossing and turning movements, appears to offset amply the added costs of right of way and construction.

Intersection Design. As volumes grow, the need for separating the grades at major highway intersections or adopting other means for protecting their traffic becomes more pressing. Where the movements on both highways are very heavy and approximately equal, it is probable that the separation of the clover-leaf type is the most effective treatment. However, in locations with somewhat less traffic and particularly where more than two highways are involved in the intersection, well designed traffic circles often accomplish the same purpose.

At intersections of divided-roadway trunklines with roads of minor importance, some use has been made of a modification of the traffic circle. In such cases access across the center strip is by means of roads some distance on either side of the line of the cross road. This compels cross-road vehicles to take a roundabout path with ample opportunity for seeing and avoiding conflict with trunkline traffic.

Urban Conditions in Rural Areas

The extension of suburban development along trunklines radiating from urban centers has created problems of safety unlike those found in either purely urban or rural areas. The numerous intersections with semi-urban streets, the clustering of business places along

the highway, the great increase in local vehicular and pedestrian traffic, all multiply hazards in these locations.

Studies in areas within 15-mile radii of Michigan cities of 5,000 or more population show the results of these conditions in terms of fatal accidents. These areas contain 38 per cent of all rural trunklines in the state, but they accounted for 63 per cent of all fatal accidents on rural trunklines. Within a 3-mile radius, with only 8 per cent of rural mileage, one-quarter of all fatal pedestrian accidents on rural trunklines occurred. Within the 15-mile radius were concentrated 78 per cent of all intersection accidents. Between-intersection accidents predominated in every 3-mile radius except around the three principal cities.

The lessons to be drawn from this disclosure of the concentration of hazards in these expanding suburban districts may be briefly stated. Sidewalks for pedestrians are an inescapable part of highway construction in these areas. The greatest care must be exercised in designing and providing intersection facilities; where no separation or traffic circle can be provided there must be assurance of full sight distance. To accomplish this and to guard against dangerous development too close to the roadway, broad right of way must be secured—broad enough to accommodate side service roads where they are necessary. Aside from this, such measures as intelligent speed zoning and strict enforcement must be relied upon.

Conclusions

The phases of safety design discussed in this paper are only details of the whole job of the traffic and highway engineer. It may be said that they are only the minor minutiae which go to make up those details. But the highway and safety job is too complex to be comprehended in any single study, and it is only by isolating and solving its details that an acceptable highway system can be evolved.

Safety design is, as has been said, the refinement and perfecting of the means by which the fundamental requirements of highways are met. If streets and highways are made safer, they are also made more convenient for the use of the motorist and more efficient in their service to the community. Traffic travels more smoothly over them with less friction and less delay. When, through the analysis and adjustment of details, we can eliminate the comparatives from that statement and say, "Traffic travels smoothly without friction

or delay," the highway and traffic engineer will be warranted in feeling that he has his job well in hand.

DISCUSSION

Henry L. Howe
City Engineer, Rochester, N. Y.

Mr. Mickle has so thoroughly covered his subject, in a general way, that it will be difficult to add new ideas or criticisms of a constructive nature without going into design details.

Very early in his paper Mr. Mickle makes the important statement that "Reckless and careless driving are primary causes of traffic disaster, but at the same time better facilities will make recklessness less likely and carelessness less costly."

The old idea of attempting to control traffic speed by obstructing its free flow is basically wrong. A sailor or ship pilot does not like channel buoys placed in the center of his channel, but desires a channel adequately marked as to the safe limits for navigation, yet sufficiently wide to allow adequate space for maneuvering. We all look back with some amusement or possibly horror at the first attempts to control automobile traffic by the use of "thank-you-mams" placed in the business streets of our rural villages or the poorly placed "isles of safety" or the traffic standards built of concrete or stone obstructing the entrance to narrow streets or at busy intersections. These were placed, I believe, largely with the idea of protecting the pedestrian, with little thought given to the necessity of rapid and smooth flow of vehicular and pedestrian traffic. We must design so as to protect the innocent or careful from the fool or reckless driver.

When the general public is fully awakened to the extent of the slaughter on our highways it will be considered ethical and not "squealing" to report the license number of the car that dashes past you on the heavy traffic highway, regardless of the rights and safety of others, and cuts in ahead, requiring you to jam on your brakes when the selfish driver is forced into the proper traffic lane as he suddenly sees a car approaching over the hill. Proper investigation of such reports by responsible authorities should do much to cut down our accidents on the highways.

Pavement Width

Mr. Mickle gives a lane width of 10 feet as the standard in urban communities. It is believed that in our older cities where traffic speeds are well within 35 miles an hour, that a 9-foot traffic lane must, in many cases, be used, because of the prohibitive cost of widening the pavements or providing parallel streets. It is agreed that in designing new street lay-outs lanes of 10 feet or even wider would be desirable.

When streetcar tracks are in the street center, it is not only necessary to provide additional width to obtain traffic capacity compared with a street without such tracks, but additional width must also be provided to allow space for car loading platforms or areas at necessary points. If two lanes of traffic are to be allowed between the loading points and the curb, a pavement width between curbs of at least 60 feet is required. When buses run in the streetcar area, a slightly wider passenger loading area is desirable. However, when streetcars can economically be eliminated and the tracks removed or paved over, particularly in narrow streets, and the cars replaced with gas buses or trolley buses which can stop at the curb, traffic in general can usually be speeded up and the street made much quieter and of more pleasing appearance. Such elimination of tracks on streets and adequate resurfacing will attract traffic from other streets and thus relieve their overload, where such conditions exist. Where the cutting down of trees to widen a street is a determining factor, the elimination of the tracks may be a solution for some time to come.

It is hard to agree with Mr. Mickle's statement that consideration for the safety of pedestrians forbids that urban arteries be wider than the equivalent of two lanes for moving traffic in each direction unless safety islands are provided between the center area and the curb. It would seem more practical to control the traffic by stop and go lights and to educate the pedestrian to cross only on the red light than to consider such narrow pavements in our larger cities, unless they can be widened at the intersection and traffic dividers constructed at these points. Synchronizing of the traffic lights to collect the vehicular traffic so it will proceed in surges or platoons, and prohibiting right turns in congested areas, would help protect the pedestrian in crossing the street.

Mr. Mickle, in speaking of the design of elevated streets, men-

tions the experiments being carried on by the use of narrow traffic-dividing barriers to separate the opposing streams of vehicles. I mentioned before in my discussion the danger of confining traffic by barriers such as curbs, etc., which limit the space required for maneuvering to avoid accidents. However, since these elevated highways are constructed to carry very fast traffic, it seems necessary for safety that the traffic in opposite directions be separated by the use of medial strips or at least by small divider areas, even though they may add materially to the cost of such structures.

Question of Intersection Design

The question of intersection design might well be the subject of a paper rather than a few paragraphs in a paper. The old "isle of safety" is now being replaced with carefully designed traffic separators or dividers constructed with due regard to the needs of the vehicular traffic, as well as of the pedestrian traffic. This has developed into the control of traffic at intersections by use of channelization, which requires the vehicles to drive in restricted channels, reducing or controlling their ability to maneuver, but providing adequate lane widths, adequate radii to permit proper turning, etc.

Many novel intersection designs have been constructed for safety and to relieve traffic congestion, such as those used on the Mount Vernon Memorial Highway, and the unbalanced type of intersection design used in Indiana, in which additional traffic lanes are provided for vehicles approaching the intersection, the remainder of the pavement at the intersection maintaining its normal width. Corner by-passes, to clear traffic desiring to make a right turn without blocking the flow of such traffic during the stop-light periods, are coming into wider use. The use of deceleration lanes and splaying for turning or stopping of buses is growing.

The original "traffic circles" were not always properly designed. Modern designs of this character might better be called "rotary traffic intersections" rather than "traffic circles."

Too much stress has often been laid on symmetry of design of such intersections. The dimensions of such work are so great in the field that true symmetry means very little from the standpoint of appearance or efficiency, except possibly from the view of those in an aeroplane or in high buildings.

Many intersections can be greatly improved by cutting the corners to give adequate turning radii. The old 13 feet or less radius for

curb at intersections is giving way to radii of 20 to 40 feet to permit a large bus or truck to turn without encroaching on the adjacent traffic lane or wrong side of the street to avoid running over the sidewalk at the corner.

Parking requirements alone cover such wide interests that a discussion of Mr. Mickle's paper must be confined to narrow limits. However, I wish to question, in most cases, the advisability of the establishment of publicly owned parking lots, unless leased for private operation under proper terms, in order to relieve the parking requirements in the public streets. The tearing down of old buildings in the business areas, in order to save taxes during the depression, has not proved all loss. Such vacant land has in most cases been operated privately as parking lots and has not only relieved street parking to a great extent, but by providing such parking facilities has helped maintain values in the central business districts by making it easier for clients or shoppers to reach stores and offices even with the increased congestion due to growth of our traffic. This land use has also made it possible for such properties to pay some taxes on the reduced assessment basis.

New stores or commercial establishments should in the future provide adequate parking areas for their customers, or band together with other establishments to provide such parking areas, and not leave it to the city to provide public parking or storage facilities.

An adequate, well-thought-out Major Street Plan properly adopted by the governing body is a basic requirement for any city. Such a plan must be kept alive and growing, and not allowed to become stagnant or poorly enforced. Proper future street lines fixed on such a plan must be observed in approving the construction of new buildings, or street widenings.

On old residential streets which are gradually becoming apartment or club districts, it is possible to require service streets to be constructed according to the general plan. Thus the trees are saved and parking in the main artery is eliminated.

Proper street cleaning is made very difficult by night parking in public streets. Some engineering control of street pavement marking and the installation of other traffic control devices are desirable. We have all seen six-lane streets marked out as four-lane streets with little or no consideration being given to the areas required or

used for parking. How can the public be educated to keep within traffic lanes which are so carelessly marked?

Mr. Mickle has not covered the design of streets at highway-railway grade crossing elimination structures. This is a subject worthy of considerable study. Such streets to be safe must be constructed with safe approach grades, usually not over 5 per cent, safe pavement width without center supporting piers under the railway structure, sight distances as great as reasonably possible, vertical curves at the start of the approaches and under the structures with a radius of at least 200 feet where possible, and with adequate lighting facilities.

I will leave to others the discussion of Mr. Mickle's paper so far as it covers rural highways, with only a few remarks. It cannot be expected that careful drivers on a high speed highway will keep close to the right-hand edge of the pavement as long as parking or stopping is permitted in the pavement area or as long as driving at speeds far below the safe speed set for the highway at this point is permitted. Often a wider outside lane, where curbs are used, will help keep the vehicles in the outer lane.

Again, as long as highway departments insist on placing "Slow" signs at every curve in the highway rather than a "Caution" sign or a sign setting the safe speed for the curve, it cannot be expected that the average driver will have much respect for signs.

The design of highways to provide adequate sight distances, horizontal and vertical curves of large radii, with adequate banking (outside of cities), the use of pavements with relatively non-skid surfaces, and the construction of sidewalks in rural areas where needed, will do much toward making our highways safer for all.

GEORGE M. SHEPARD

Chief Engineer, Department of Public Works, Saint Paul, Minn.

THE PAPER by Mr. Mickle covers the question of street and highway design for traffic safety very thoroughly. My remarks will consequently be brief. Mayor La Guardia yesterday advised us to keep out of this traffic business. We are like the banker who financially backed the contractor. He was soon in the contracting business himself whether he liked it or not. Those of us who have to do with street design are definitely in the traffic business.

Mr. Mickle has stated that too much reliance for safety cannot be placed on the physical design alone. For the greatest degree of traffic safety, design must be coupled with adequate traffic control and traffic code enforcement by the police department.

Streets and highways in urban and semi-urban areas must be properly illuminated for night driving. Outside of the field of highway design and traffic control the automotive engineer, by introducing the use of glass designed to polarize light from headlights, may easily in the future add greatly to the safety of night driving by the elimination of glare.

While heavily traveled city streets are fairly well lighted in general, there are frequently highways of a semi-urban nature, which connect with the country highways but are in the city limits, which are not so well lighted. Such highways, where not of double roadway design, should be center-striped and adequately lighted. In Minnesota, where no refund of gas tax to municipalities is made, the State Highway Department has undertaken the extension of trunk highways into the cities and has given much study to the matter of safety design. The painting of lanes at intersections of heavy traffic volume to provide traffic channelization, and sufficient traffic supervision by police to keep traffic moving promptly on signals, assist greatly in reducing congestion.

In 1929 Saint Paul undertook a street widening program to cost approximately $5,000,000 for land acquisition alone, the principal item being to open a wide arterial highway on each side of the loop district to facilitate the entering and leaving of traffic. At the Kellogg Boulevard edge a double roadway was constructed as part of a landscaped esplanade. On University Avenue, the main thoroughfare between Saint Paul and Minneapolis, the roadway width on the 120-foot street is being widened to 95 feet, giving three effective traffic lanes on each side between the streetcar track and the parked car area. Progressive traffic control is provided for five out of the six miles by the recent installation of traffic control signals which are placed approximately two blocks or one-eighth mile apart and regulate speed on the Avenue to an average of 27 miles an hour.

Demands for funds for relief and other purposes have, I believe, generally eliminated consideration of street widening in most cities at this time, except in special cases. A complete study of sources and destination of traffic frequently indicates that in lieu

of street widening other routes may be improved and that traffic may be distributed over several streets instead of being confined to one.

Overnight parking in residential streets is not only a menace to values and safety as pointed out in the paper, but also is an obstacle to street cleaning and snow removal operations.

Elevated express highways with ramps and street grade separations are of course excellent for providing safety in congested traffic areas, but their construction is necessarily limited to special cases or to areas of high real estate values such as exist here and in other larger cities.

While most of us will not, I believe, lay any claim to being expert traffic engineers, we can, by means of commonsense highway design along accepted principles as to lane width, intersection design, etc., greatly aid in the safe use of streets and highways.

CARL V. BERGSTROM

Traffic Engineer, Department of Public Works, Milwaukee, Wis.

MR. MICKLE in his discussion of street and roadway design for safety has painted a picture of basic premises for safety in the movement of traffic through urban and rural areas. In this picture he has drawn the horizon of limitations beyond which traffic safety does not exist. This horizon tells us of the proper lateral and longitudinal characteristics of roadway design proper for expeditious and safe movement of traffic.

He has painted a sky of illuminating facts which throw light on the economic background of our motor vehicle transportation system. The needs in urban areas are toward the moving of large amounts of traffic according to a predetermined economic schedule dictated by the people's living habits. In the rural areas it is the long distances between origins and destinations of traffic that govern roadway design and planning. This brings in the elements of speed and non-stop traffic.

In the foreground of his traffic picture, Mr. Mickle places certain traffic engineering designs and criteria at our disposal through the defining of such terms as street capacity, elevated streets, intersection design, parking requirements, and their proper relationship with each other.

Urban Areas

Mr. Mickle in his discussion of street capacity points toward the fact that when traffic volumes are studied they must be viewed through the functioning of all arteries of the city. There are direct relationships in the traffic pressure at different points throughout the city and at different times of the day just as there is a direct relationship in the human body of the blood pressure and flow to the pumping of the heart.

Traffic in an urban area cannot be expected to flow freely if the natural course has been blocked or narrowed at certain critical points in the street carrier system. It is these points, in agreement with Mr. Mickle, that should be corrected in view of excessive traffic conditions at other points. Mr. Mickle's discussion of 10 feet as standard width for traffic lanes, conditions influenced by the presence of streetcar tracks, and parking practices, merits consideration in the planning of any traffic improvement.

Mention is made of safety islands for the protection of the pedestrian, and possibly this point may be enlarged. Safety islands are probably the traffic engineer's most valuable tool in city street and intersection designing. The practice of installing safety islands at intersections is generally known as "channelization." The islands perform the function of directing and guiding traffic, through their presence in the area of the intersection which should be normally unused by vehicles in their logical courses. In contemplating the installation of safety islands, the foreshortening to the driver's vision of longitudinal roadway objects should be taken into consideration. Any island or other arrangement designed to have an effect upon the motorist's vision, and to guide him by its physical appearance, should have a length of at least 30 feet. Island lengths ranging from 60 to 80 feet are well recommended. "Pedestrian safety factor" is another term that has been created to describe that part of the safety island which is normally not used by the pedestrian but which acts as a buffer between him and the moving traffic. In an island 80 feet long this area may be as much as 75 feet. In other words, 75 feet of the island may be violated by the motorist without coming in physical contact with the pedestrian. This is the secret of islands within the stream of traffic flow that are effective without any bumpers or positive obstacles to the movement of vehicles. We hear much of streamlining in all modern

design, and it has been proved that streamlining of islands with the narrow point toward the oncoming driver's vision has the definite value of almost subconsciously directing attention toward the island. An 80-foot island of this type would take the physical dimensions of a 3-foot radius on the large end and a 1-foot radius on the small end, connected by tangents. The perpendicular sides extend 5 inches above the pavement.

In the average American city it is felt that the moving of the major traffic still has to be solved at ground level; therefore, to enlarge upon the *limited way,* the following points should be considered in addition to elevated streets. A true limited-way street should have a center dividing strip. A wide center area would probably be most desirable, but, in agreement with Mr. Mickle, this is almost an impossibility in view of the high cost of land and the fact that private property lines are quite well established. This brings a narrow parkway into the picture almost as a matter of necessity. Such narrow strips 4 to 5 feet wide may be made doubly effective if a continuous shrub or hedge is planted within the entire area. This hedge then will perform three functions:

1. It will eliminate in a positive yet aesthetic manner mid-block jay-walking.

2. If the hedge is high enough, it will obscure blinding headlights from the oncoming vehicles.

3. The hedge, which should be of hardy growth, will act as a physical buffer if vehicles out of control forcibly attempt to cross the center area. It is entirely within reason that this hedge may of its own tenacity bring a vehicle to a complete stop almost as effectively as the brakes on a car.

It is felt that the time has come when some drastic solution must be put forth to overcome the static elements of private property in preventing the development of true ground level limited-way streets. It is in this spirit that the following suggestions are offered.

Through the length and breadth of the city in at least four directions running with the gridiron pattern of the streets, the block between two city streets might be completely taken over with the purpose of developing the express highway system of the city. This may sound like a "brain trust" idea at its worse, but the private areas which are so disposed of for the new express highway could be reimbursed not in dollars and cents, but in an exchange of properties at the far extremes of these express highways, out beyond

the limits of the city. In other words, it is felt that the presence of these express highways would cause outlying properties in their vicinity near the city limits to be of high premium value. A city government undertaking a plan of this sort would purchase these outlying properties before their values had been enhanced by the building of this express highway. Each lot so disposed of within the city would be given a fair and equal value in property along this highway out near the city limit areas. When the highway was finally completed, those areas that had been exchanged for disposed lands would have more value than some very high priced lands within the city itself because of their ready accessibility to the downtown areas.

This is offered as a bold solution to the problem of the express highway system for the American city in the near future. Such a system should not be so costly as elevated highways and certainly not so disfiguring to the topography of the city.

To further much valuable field research in traffic engineering, it is suggested that large American cities study the proposal of setting aside certain streets for experimental purposes. Such a street should be built primarily along the express highway lines, and even though it be short in length as a matter of necessity, it will be adequate to try out many new traffic devices. On this street it is suggested that the narrow center parkway, including the traffic safety hedge idea, be given exhaustive tests. This traffic safety hedge should also be installed at street curbs further to prevent jay-walking and to make a practical impossibility of curb parking where it has been prohibited by law. The perfection of speed control through traffic signals could well be worked out on a street of this type, even though it meant that traffic signals must be installed at mid-block merely for the purpose of keeping platoons in order. This would offset the necessity of having signals at intersections even though they do not diagrammatically fit in with a flexible progressive timing diagram. The mid-block installation of signals allows them to be put any place along the diagram where they fit in with the proper speed band.

One point that has not been discussed thus far is the development of every possible traffic engineering idea for the protection of school children. It is felt that around every school building and playground within the urban area the idea of the continuous hedge at the curb is well taken. Children are most often injured when

they run out into the street while concentrating on some game or other activity. The hedge along the curb absolutely prevents this, and also enhances the appearance of the school and adjoining grounds. It is very easily maintained by special equipment similar to a farm mower, which trims the top of the hedge parallel with the top of the curve.

Rural Highways

Mr. Mickle has given us the gist of the findings of some very interesting and valuable traffic surveys on vehicle placements as observed along U. S. Highway No. 10 between the cities of Pontiac and Flint. Undoubtedly these findings will take their proper place as factual data for use in the lateral design of rural highways. It is felt that broadly speaking these experiments show that while a 10-foot lane is accepted as standard for city traffic, only 11 feet can be considered a minimum for rural traffic.

Another survey described by Mr. Mickle concludes that the presence of truck traffic on a rural highway increases by 2.58 times the chance that any individual vehicle operating on that same road will have a collision. This is a finding that should be kept uppermost in the minds of all traffic engineers in attempting to decide whether trucks should be kept off the heavily traveled highways, whether they should be allotted a special truck traffic lane on the same highway, or whether separate truck routes should be developed upon which passenger vehicle traffic should be discouraged. Surely, an increase of 2.58 times in accident probability just because of the presence of truck traffic cannot be easily ignored.

The discussion on multiple-lane and divided roadways brings into the open that controversial statement as to whether all rural highways must be divided. There is no question that ultimately the divided highway will probably be the best solution, but in the interim, as Mr. Mickle explains, we must work with the tools and the money available. Along this line it is felt that much has been done in the last year to remove the stigma from 3-lane highways as the most dangerous type of thoroughfare. However, there are certain inherent dangers in this type of highway. One of these, that of passing on curves and hills where the sight distance is not adequate, has been given careful consideration and a solution is now being tested in Milwaukee County. At all points along 3-lane

highways where the sight distance is considered inadequate the roadway is re-marked into a 2-lane highway, which means that all traffic moving through this area must stay on its half of the road. This simple arrangement has brought very happy results in Milwaukee County in the form of reduction in accidents. Possibly in Michigan they have followed this plan and it accounts for their good record over a four-year period.

In taking up the matter of divided roadways Mr. Mickle emphasized the need of the center strips being of adequate width. It may be again noted for the record that the center strip continuous hedge should have just as much merit along a rural highway as on a city street. Along the rural highway the problem of headlight glare is even more acute than on city streets, and the need of some kind of shock-absorbing device, when a car out of control attempts to cross the center strip, is obvious. If this hedge is incorporated in the divided rural highway it is felt that the strip may be of minimum width, therefore saving much valuable space that can be better used for roadway area.

A note of warning should be given about placing any obstructions in rural highways that have not the proper longitudinal visibility to the oncoming motorist. This warning is especially directed toward rural intersection design where channelizing islands are placed within the roadway to vary the course and cut down the speed of through traffic. Such islands, if they are used, should be backed up with longitudinal directional islands running at least 100 feet back of the intersection in each direction.

Traffic signals at rural intersections also need further study toward the design of a signal with much better visibility during daylight hours. Stopping a vehicle traveling at 50 to 60 miles an hour by means of a traffic signal is much different from stopping urban traffic with the same type of signal. Much stronger lamps should be used in the signals and adequate background targets for the signals should be installed even at the expense of their final appearance.

Under the heading of urban areas within rural districts, it is felt that one suggestion at this time might prove a possible solution. In many of the large cities of the country the problem of keeping down semi-urban traffic accidents has at least been partially solved by a network of divided highways through the areas influenced by the city itself. In Milwaukee such a roadway system leads to the county limits in three directions.

Conclusion

It is felt that in the future much more imagination must go into experimentation toward the development of safe city streets and rural highways, especially in the cities where admittedly the gridiron pattern of streets as it now exists is a mere stop-gap for the development of something radically different. Who, then, but the traffic engineers should take this initial step to offer solutions which, though radical and different, still stay within the realm of practical and financial possibility.

The American city that does not solve its traffic carrier problems within the next ten years will definitely be relegated to the scrapheap of American metropolises. Thus far, our American metropolitan scrapheap contains only extinct mining towns, passé lumbering towns, and other cities where a one-time industry has moved out. It is possible that this tragedy may be repeated in some of our very large American cities if industry, because of transportation problems, finds it economically not feasible to operate, and if the citizens move to suburban areas to avoid intolerable city traffic conditions.

Traffic Engineering—in the Police or the Engineering Department?

Robert A. Mitchell

Traffic Engineer, Philadelphia, Pa.

The subject which I am going to discuss, of course, has a great deal of bearing on the public safety of the citizens of every community and every state in the country, and as such it should be of interest to all public works engineers.

I notice that this subject was fairly well discussed back in the 1932 *Proceedings*. One of the municipal engineers made a statement during the discussion after a talk by an educator on what they were doing to educate the high-school students and the younger students. He said, "You are doing good work, better work than these traffic engineers." I just want to bring that out, gentlemen,

to show you the sentiment that existed at least among some of the public works engineers in 1931.

Now, traffic engineering is not a panacea for this traffic problem. The traffic engineer does not believe he is the sole answer to the problem of traffic control or the saving of lives, but we do believe we can be a big help to all municipal agencies, to the department of public safety, to all those in city and state government, in helping to solve this problem.

Quoting from the same report of 1932 of the Traffic Control Committee: "Seventeen cities with a total population of over twelve million have traffic engineers." In 1938 the report of the Traffic Control Committee shows that fifty cities and twenty states, in which there lived a total of twenty-four million people, had traffic engineers. So, you can see that traffic engineering in that time, in spite of the statement made during the discussion in 1932, has increased its scope of work and is apparently doing a good job.

When the open touring car was all the vogue and linen dusters a necessity, plain highway facilities were adequate for the safe and convenient movement of motor vehicles, and police methods based on crime prevention experience were sufficient to control and regulate the actions of drivers. Now with approximately thirty million motor vehicles congesting our highways and the accident rate out of all proportion, we cannot hope to cope with the problem by these same methods. To entertain such a hope it would be just as old-fashioned as to believe that the general medical practitioner can successfully handle all the complicated diseases that beset humanity and require the attention of specialists.

I do not mean to intimate that the general practitioner does not have his place in the scheme of things, any more than I would say that the highway engineer or the police officer is not a vital agent in the correction of the traffic problem.

I was not present Monday when Mayor La Guardia made his speech to the opening session, but I understand he made a statement to the effect that we should keep our hands off the traffic engineering question and leave that matter up to the police department. I am trying to bring out here that we do not mean that traffic engineers want to interfere with the operation of the police department; we believe that the police department has its part to play in traffic enforcement. That is the agency of enforcement, but we also believe that traffic engineers can give the police officials very

many thoughts which will be helpful to them in securing better enforcement with less expense and less energy.

There still are sick people who do not require the services of a specialist, and many traffic conditions that can be taken care of without the advice of the traffic expert. However, just as the general practitioner is too intent and busy with his own work to give particular attention to the methods of specialists, so the highway engineer and the police officer have all they can do to handle their own problems. As a result, they are unlikely to analyze and study traffic conditions in the same manner as does the traffic engineer.

The traffic engineer gathers together all the available data about highway traffic, analyzes and studies it as an engineer would the stresses and strains of a structure, and applies the results to the correction of various phases of the traffic problem. As he is a specialist whose methods have improved the technique of both the engineering and enforcement sides of the traffic picture, it is difficult to give a definite answer to the question: "Should traffic engineering be in the police or the engineering department?"

Replies to Questionnaire

In order to ascertain how others in the profession feel about this question, I asked traffic engineers employed in cities and states, and other engineers prominent in the profession, to give me their opinions and also to define their particular governmental set-up. Replies were received from four state traffic engineers, three of them located in the highway department, the other under the commissioner of motor vehicles. Thirteen city engineers answered my request. Six of them said their organization is part of the engineering department; two worked directly under the director of public safety; four are located in the police department, and one is connected with the department of municipal research and service. There are other cities with traffic engineers who did not answer my letter, and three cities which have what seems to be a more nearly perfect organizational arrangement for the solution of the problem. In one the traffic engineer is a member of the mayor's cabinet with a separate department under his control; in another the traffic commission, a separate department, is the traffic engineering agency; and in the third the traffic, police, and fire departments come under the jurisdiction of the president of the board of commissioners. Practically every traffic engineer was of the opinion that his set-up

was the best under existing conditions. Some felt enforcement was the most important angle to the problem, others the engineering side. There was also about the same difference of opinion among men prominent in the profession. They all agreed on one point, however, which was that any correction of the traffic problem depends upon an improvement in both engineering and enforcement methods and that regardless of which department contains the traffic engineering organization, real success depends upon the personal attitude and cooperation of the officials in both departments and the extent of the traffic engineer's authority.

This same point was brought out very well in 1932 in the report of the Committee on Traffic Control, and, to be frank with you, I wrote this paper before I found out that there was such a report in 1932 which tied in so splendidly with what I had to say here.

Functions of the Traffic Engineer

We know that traffic engineering plays a vital part in both the engineering and enforcement aspects of the traffic problem and that it is working with fair success in both the police and the engineering departments. Let's look into the situation in more detail and see if we can determine the best location for a traffic engineering department; how much authority the traffic engineer should have over the traffic control equipment; how much jurisdiction over the change or creation of traffic regulations; and what authority with the heads of other bureaus or departments.

What did the 1932 report say? After listing fourteen things that the traffic engineering department could do successfully in a city, these two quotations were made: "It is highly desirable that the traffic engineering agency be given direct supervision over most of the activities named above." Also, "The question of whether equipment, installation and maintenance should be under direct supervision of traffic engineering agencies is important. In general this arrangement is favored. It permits of a more thorough supervision of the work exacted here as to plans and specifications, development of and adherence to the advancement of plans and schedule of operations. This plan is also more closely in line with the trend toward bringing all executive traffic matters under one responsible head."

Take the enforcement or driver-control phase of the problem;

what part does traffic engineering play in improving conditions from this angle?

Traffic engineering methods, such as training of police, creation of accident investigation squads, coordination of traffic signals, efficient use of street area, etc., can bring about an improvement in enforcement methods and the use of up-to-date control regulations which usually result in a very noticeable reduction in accidents and the freer movement of traffic. This can be accomplished only with the wholehearted support of the police. Therefore it would seem that at least in the beginning the traffic engineer would meet with much more success if his organization were closely allied with the police department. Eventually these methods will become an established policy of the department and the traffic engineer might successfully operate from another department and serve the police department in an advisory capacity.

In other words after the police department becomes used to these methods and they become a part of the police organization, it is not necessary for the traffic engineer to be directly connected with that department. He can work in an advisory capacity and smooth off the rough edges from time to time.

As the basis of most of his studies, traffic accident records are one of the most important forms of data that the traffic engineer can obtain. As these records are compiled by the police department, a traffic engineer in that department is in a much better position to see that they are adequate for his purpose and easily obtainable. Located in the engineering department, he would have a tough job doing this, if the police did not want to cooperate and could not be forced to do so by a higher official. In the opinions received from certain traffic engineers whose offices were in engineering departments, the main disadvantage of their set-up was the trouble they had in obtaining accident records.

Traffic signals, signs, and markings are all mechanical methods of controlling the movement of traffic. Their effectiveness in accident reduction depends upon driver obedience; their help in eliminating congestion depends on their design, erection, operation and maintenance. The former is an enforcement function requiring the services of the police, the latter an operating function requiring the use of engineering calculations. The failure of either side to do its duty causes trouble. To have the traffic engineer in one department,

and the erection and operation of this equipment under the jurisdiction of another, makes for inefficiency even when most cordial relations exist between departmental heads and the traffic engineer. In most cities, the traffic engineer has been given complete charge of the design, erection, and operation of this equipment. Under such conditions he can operate successfully in either the police or engineering department, or in a department of his own.

The most efficient use of available street space for the movement of traffic and the parking of vehicles is another very important phase of traffic control which involves both engineering and enforcement. The traffic engineer by collecting and studying certain data can devise regulations which, when *properly enforced,* will improve traffic conditions. As enforcement is the function of the police department, this phase of the problem could be handled better by having the traffic engineering organization in that department.

Planning and Engineering Functions

Having discussed some of the factors in traffic control that involve the enforcement or administrative side of the picture, let us consider those that are of an engineering or planning nature and see how traffic engineering has improved traffic conditions from this angle.

Providing proper traffic facilities, which includes the creation of new street areas, the rearranging of existing streets and intersections, together with the maintenance of all of the physical plant commonly known as the roadway, is a recognized function of the highway or engineering department. A big showing can be made by cutting down the weeds on ground that is to be developed into a grassy lawn, but the ground must be freed from the roots of these strangling plants before the grass seed will develop into a permanent and healthy lawn. A big improvement can be made in traffic conditions by using proper enforcement methods and better administration policies, but the creation of functionally sound traffic facilities is necessary to bring about more permanent and lasting improvements.

In Milwaukee, Kansas City, Philadelphia, New York, New Jersey, Illinois, and other cities and states, traffic engineers have demonstrated beyond a shadow of a doubt that their designs for channelization islands, traffic circles, grade separations, divided roads, and other highway improvements have not only speeded

traffic, but also have prevented accidents and reduced the conflict between pedestrians and vehicles.

The lighting factor was brought up yesterday so I need not discuss that part of the problem, but the traffic engineer has been able in some cases to advise and work with the lighting expert.

In Philadelphia, traffic engineering is a division of the police department, and yet has a say in the engineering developments, because practically all plans prepared by the engineering department for street changes require the approval of the traffic engineer. There is no law requiring this cooperation, but it is brought about through the policy of Mayor S. Davis Wilson and a good relationship between the two organizations. Under a different administration, or with a change in the top personnel of either group, conditions might change. In answering my questionnaire, several traffic engineers whose units were in the police department testified that they were having difficulty in getting support from the engineering department; others who are part of the engineering group seemed satisfied with the progress they were making on this phase of the work. Thus it is evident that to be in a position to bring about permanent traffic improvements, traffic engineering must be closely linked with the engineering department, or if he is part of another department, the traffic engineer must have authority enough to see that consideration is given to his designs for physical street changes.

I have tried to explain in detail traffic engineering functions which are doing much toward reducing congestion and preventing accidents and to show how they are allied with the work of both the police and engineering departments. Time will not permit the discussion of other phases of the problem, such as education and street lighting, but these have only a minor bearing on the question of departmental location. However, are we yet able to give a direct answer to the question: "Should traffic engineering be in the police or engineering department?"

Traffic engineering is a technical science, a very definite branch of engineering, and is entitled to the same consideration that other branches of the profession are being accorded in government. To attack the traffic problem, however, is a step into a field which for many years has been considered a police prerogative. As a result, there has always been disagreement among officials as to just where traffic engineering best fits into the governmental set-up. But why should this be? Mainly because the charter provisions of most

municipalities were formulated before traffic control was such a major problem, and public officials in organizing a traffic engineering unit have been forced to place it in an established governmental department. Now that traffic control is no longer a minor civic problem, traffic engineering, having demonstrated its value, deserves a major location in the governmental organization, established by law, so there will be no question as to its position or its functions.

In the 1932 report there is a statement given in bold type: "The chief executive and the legislative branch which holds the purse strings have failed to readjust the administrative organization so that it really meets the needs of present-day traffic conditions." Gentlemen, that is just as true today as it was in 1932. John Neeson, who was President of the Association at that time, in leading the discussion made two statements which very well fit in with what I have just said. He said that one of the outstanding phases of the report made by the Traffic Control Committee is the lack of interest shown by the municipal engineer in this problem. We might as well make up our minds that it is not only our duty but our obligation. Then in another place he says that the real reason there cannot be coordination of traffic control is because of the present set-up of departmental activities in our cities. It is true that functions are obsolete to the extent that when a nuisance like this develops, we do not have the complete machinery in one department to operate it.

I have my own personal opinion as to the most logical set-up for traffic engineering, but do not propose to send up a trial balloon to be shot full of holes. One man's opinion on a subject of this kind would not get very far.

The 1932 report recommends certain things on page 173 which I believe tie in very well with my recommendation. It seems to me that organizations such as the American Public Works Association, International Association of Chiefs of Police, Institute of Traffic Engineers and others, should be interested enough in the problem to make a thorough study of all the facts and then recommend to public officials a uniform and practical organization for handling the traffic engineering side of the traffic problem.

DISCUSSION

HAROLD F. HAMMOND
Director of Traffic Division, National Conservation Bureau, New York, N. Y.

I THINK Mr. Mitchell has given us a very excellent word picture of the traffic engineer and his responsibilities, and also a very good picture of where he personally feels the traffic engineering department should be located in the city government. Of course, I too rather hate to send up a trial balloon and have it shot full of holes, but I am going to put one up a little way and if I think you are going to shoot it full of holes I will yank it down.

Everyone is entitled to his own opinion and I am going to express some of my opinions. Possibly in the way of background I might say that serving as secretary-treasurer of the Institute of Traffic Engineers for the last three years has given me a very broad insight into the responsibilities of the traffic engineers, their trials, tribulations, and activities throughout the United States. It is largely based on my personal experience with the men in the field that I make these comments this morning.

Mr. Mitchell brought out a good point at the beginning and as a matter of fact said it a number of different ways throughout his entire paper, and that was that traffic engineers should be engineers at the outset, and they should, of course, base their experience on their past training.

Now, don't gather from my remarks this morning that I am encouraging the police officer to take over and do the job of traffic engineering, although I am going to refer from time to time to the police officer and his work along this particular line.

As to the question of the traffic engineering's being in the police department or in the engineering department, I would say that my study reaches about the same conclusions as does Mr. Mitchell's. Today we will find traffic engineers divided about evenly between the two departments, particularly in the larger cities. In state governments you will find the majority of them located in the engineering department or in the highway department. Mr. Mitchell, of course, spoke of the ideal location as being entirely separate from either—serving under the police chief, the commissioner of public safety, or whatever you may have along the police line, or serving

under some subordinate in the public works department or the city engineering department, whatever that may be. In other words the ideal plan is to set up a department entirely separate and establish in the city government a new division known as the traffic engineering department.

The Ideal—A Separate Department

How well you men are acquainted with traffic engineering, I don't know, but I do know, based on the opinions of a number of men prominent in the engineering field and of the traffic engineers and their accomplishments throughout the country, that traffic engineering wants a special department in the city government. Schenectady is one of the most recent to establish such a separate division of traffic engineering. I believe that Detroit has set up the same thing now, and Jackson, Mississippi, has taken a similar step.

Of course, we cannot all have the ideal set-up, and there may be instances where the ideal will not prove most successful at present. What then? Well, my answer is to put it in the engineering department and not the police department. Let me show you if I can in the next few minutes why I think that is advisable.

To begin with, I don't believe it is well to have engineering work done under the police, who possibly are not of an engineering type to begin with, and quite possibly do not believe in the scientific approach or engineering methods. Again, I am not speaking just of those cities of a population of a million or more; I am trying to bring it down to communities of, say, from fifty thousand on up, and you are well acquainted with the police departments in the smaller communities. We still have lots of police chiefs who are not of a scientific or engineering turn of mind. How can we have a traffic engineer and a traffic engineering department serving under a man who does not believe in the principles and the approach that the engineer wishes to use?

Don't think I am not a good friend of the police. I have been teaching in their police schools for a good many years and consulting and working with them for about ten. They are doing a good job and I am not criticizing their enforcement work. In fact I even teach traffic engineering to the police. But, I have seen too many examples of traffic engineers and engineering graduates who have had five, ten, or fifteen years of experience in engineering, and particularly in traffic engineering, tied down and unable to do the

kind of a job they should do, because of their superiors, usually the chief, and sometimes the captain, the lieutenant, or the sergeant. (I am speaking now of the larger cities, cities of approximately one hundred thousand population.) You can't hope to turn out the kind of a traffic engineering job that should and could be done if the work was done under an engineering set-up.

Local Considerations

But again I must agree with Mr. Mitchell that in the final analysis it depends on the individual city and the conditions existing in that community. I am trying to bring this down to a practical standpoint where we can apply traffic engineering and get the quickest results. Of course, I know we can shoot off into the distance of ten or fifteen years and say "Ideally it should be here," and "In all cases it should be the engineering department," but to come down to today, and to put it in that department where we will get the most good out the traffic engineering idea, it will all depend upon local conditions and the individual community. So, don't think I am making a strict rule or trying to draw the conclusion that in every instance it should be the engineering department. What do the police say about this? How do they feel toward the traffic engineer? Do they want it in their department? No, the police do not want to have the responsibility of traffic engineering.

George Reyer, president of the International Association of Chiefs of Police for the last year, and Chief of Police for New Orleans, made a statement that was put into the introduction to our publication entitled *Traffic Engineering for Police* to the effect that the police do not want traffic engineering responsibilities—that it is not their place nor duty to have this function within their department, any more than it is their job to design the streets or put in sewers, water works, etc. Why are they doing it then? They are doing it largely because nobody else in the community wants to assume the responsibility—because the engineers of the community, the engineering department, are not ready to take over this job. As Mr. Mitchell pointed out, more or less it has "jest growed," like Topsy.

When we first got the automobile the public turned to the police as the group that should provide the necessary enforcement of the laws. Then as we began to see that we needed some control devices, minor changes in our street layout, they said, "The police are doing enforcement work and so let them do the other jobs," and so we

never really analyzed where the traffic engineering work should be done.

A while ago I mentioned the fact that the National Conservation Bureau in cooperation with the International Association of Chiefs of Police had recently published a booklet of about a hundred pages entitled *Traffic Engineering for Police.* Why should we publish such a booklet for the police? Why not publish it for the engineers? Well, there are several reasons. First, in looking over the general picture today as to which departments are doing the most traffic engineering work, we came to the very definite conclusion that the engineering departments right today are doing more in applying traffic engineering technique than any other department of the city government. Obviously we wanted to direct our attention to those departments doing the most with the subject at present. Second, we realized that if the police are to do a better enforcement job, we have to educate them a little as to what traffic engineering is and what it can do. After all, we expect them to enforce about ninety per cent of the regulations the traffic engineers devise, and unless they understand why these things are being done we can't expect them to do the best enforcement job. In the third place, looking a little ahead, we felt that by giving the police a picture of what a big job traffic engineering is they might immediately say, "That is for an engineer, or a traffic engineering department; it does not belong to our department." That, gentlemen, is proving true. Many of them have already said that.

I said that it has been my pleasure to teach in many police schools in the last four or five years. I usually teach in six or eight of those throughout the year all over the country, giving short courses of fifteen hours on traffic engineering. My purpose again is largely along the lines I have just indicated—to help those men who have to do something in the smaller communities with this problem, to educate them as to the values of traffic engineering so they can do a better enforcement job, and to give them a picture of the size of the job so that the police will immediately say that they must get rid of it and give it to the group that should have it—the engineers.

The Problem in Small Communities

So far not much has been said about traffic engineering in the small communities. Just a word about that. I have, of course, already brought out that most of the traffic engineering work in the small

communities is being done by the police departments. Again let me say that is because the engineers won't take hold of it—and that is a direct challenge to you men here and the groups that you represent. It is up to the engineer to take hold of it.

In line with that, let me tell you a little incident. Rutgers University asked me to teach a course down there this fall on the subject of traffic engineering. They hoped to have as students for this course, city, county, and state engineers, mostly, of course, from New Jersey. They sent out a feeler in June to all of the engineers in New Jersey telling them about this course. Now you can't say it was the instructor that made them reply as they did, for the instructor wasn't announced. Well, this feeler asked if anyone from the local engineering department would be interested in attending this particular course, and fifty per cent of the replies came back saying, "We think you have misdirected your letter. The police department is doing all of the traffic engineering in our city. We do nothing along that line at all." That came back from the city engineers or the members of the engineering or public works department of all the communities in the state. That is a direct challenge to the engineering profession to do something along traffic engineering lines soon.

Coming back to this subject of traffic engineering in small communities, again I say that in the majority of cities down to fifty thousand population it should be done in the engineering department. A specially trained man should be in charge of that work. If a community is so small it cannot afford to have him doing traffic engineering work alone, at least that community can have some individual in the engineering department assigned to traffic engineering responsibility, and below fifty thousand population you will have to depend more than ever on the situation or conditions existing in the individual communities.

Well, this all points to one thing. We do need a lot more study, as Mr. Mitchell brought out, and I do hope that further thought and consideration and discussion will be given to this subject today and this year to come. I know that the Institute of Traffic Engineers would be happy to cooperate with any other groups in undertaking a very broad study of this entire subject.

Traffic and Parking Control

A Panel Discussion

CHAIRMAN PHILLIPS: This is a panel discussion to consider traffic and parking control. The members of the panel are as follows: PAUL OPPERMANN, Assistant Director, American Society of Planning Officials, Chicago, Illinois; THEODORE E. TRANSEAU, Assistant Director, Department of Public Safety, Philadelphia, Pennsylvania; EDWIN F. KOESTER, Survey and Traffic Engineer, Wilmington, Delaware; and THEODORE M. MATSON, Bureau for Street Traffic Research, Yale University, New Haven, Connecticut.

After the panel has discussed this problem the audience will be given an opportunity to ask questions, and I hope that you all will participate.

Our subject is a rather broad one and I know that we can't talk about everything we would like to at this time. However, I should like to ask first what you think is mainly responsible for our traffic troubles?

MR. MATSON: Well, Mr. Phillips, I think the factors that enter into the causes of our traffic troubles are several in number, perhaps an infinite number if we were to set them all down to the last detail, but they can be classified in a few major groups. Probably the most basic factor is the transition from riding in groups or mass carriers to the individual type of personal carrier—the automobile.

Through the use of the automobile, there has been a very large increase in the areas of congestion. Of course, coupled with that have been the tremendous changes in the character of the areas themselves, such as the great amount of additional floor area that was put on the same basic land area. With all considered, a large number of factors may be recited. However, I think apropos of our discussion today we all admit at once that it is this transition to the personal convenient type of transportation which has brought on the traffic problem and which is the nub of the whole thing.

In the first place a great deal more street area or a greater facility of movement to accommodate each of those individual units in motion is at once demanded, and secondly, and probably a little more to the point, practically little or nothing has been done to provide suitable terminal facilities for handling these large numbers

of passenger carriers. It seems to me that we have been more or less like ostriches when it comes to thinking rationally about the terminal problem of our passenger automobiles.

I think in summary I might say that the parking of vehicles at the curb is unquestionably a major factor in the congestion and to a certain degree in the hazards which exist in our focal areas.

CHAIRMAN PHILLIPS: In other words we fail to provide for the storage of vehicles.

MR. MATSON: We have been taking care of the traffic for the time it is in motion, but not when it stops. Cars parked on the side of the streets use up space that should be used for transit.

CHAIRMAN PHILLIPS: I was very much interested in Mayor La Guardia's remark that the engineers knew how to solve this traffic problem but that no city had the money to do the job. What do you think about that?

MR. OPPERMANN: The Mayor is absolutely right. The fundamental trouble is that we have an obsolete street pattern for a modern vehicle, the automobile and the rapid transit vehicles which come into the congested area. The street system was laid down before we had the fast moving high-speed vehicles in large numbers, and, to be perfectly frank about the street system, I would say that it is obsolete. However, the street system, laid out in the early years, has been the framework of land development and of the structures adjoining the streets. Because of the tremendous investment made, any change in the street system involves a very considerable expenditure. It is not only the cost of widening the streets; that is negligible as compared to the cost of acquiring land by condemnation and of shearing off structures. There is no question but what any fundamental changes will run into tremendous sums of money, particularly in the larger cities.

I think one alleviating factor in that direction is the considerable flight from the central areas in some of our cities. This decentralization has left some old properties, which in many cities have been removed and the area since utilized for off-street parking. We find in many cities very considerable activity in that direction during the last ten years. Detroit is a good example. There the number of buildings cleared in any given year has reached the rather amazing total of seventy-five or one hundred, leaving areas which have since been turned into parking lots for automobiles.

I don't wish to dwell on that phase of our subject because I do not

think it is a large one, but I think if we can work on the idea of off-street parking we will be able to throw out some suggestions of some value. Of course, the parking cannot be a hit-or-miss proposition; there has to be some planning in it. We should have some surveys of the central areas to determine where the most congested areas are and then should try to adjust not only the location, but the areas and the types of facilities. Sometimes just a cleared lot is needed, in other places perhaps a two- or three-story structure, or perhaps we might have a parking garage. What is needed will be shown by basic surveys which I would like to mention at this time.

I think it is important at the outset of a discussion of any method of relieving traffic conditions in a central area to take such surveys into consideration, as the over-all comprehensive traffic survey has a very great value in that connection.

Chairman Phillips: What has Philadelphia done in the way of providing off-street parking?

Mr. Transeau: When Mr. Oppermann was speaking I was wondering if he was thinking of this rapid development of parking lots as the solution of our problem, or that it is necessary for the municipalities to step in and do something more extensive about it. What has happened in Philadelphia has happened in most of the larger cities. We heard a little bit about Chicago and the off-street parking, but in our case nobody did anything about it. However, as the depression continued and people did not want to pay the high taxes, they tore down their property just as people did in Detroit and elsewhere, and we have somewhere between six and eight hundred parking lots in various sections whereas we had only about one hundred of them in 1931. The result now is that the price for parking has gradually lowered. At one time it was forty or fifty cents in any part of the city and today in some cases it is only a dime or fifteen cents in locations that bring you fairly close to the section you want to reach.

I don't think we have nearly as much congestion as certain other large cities, because of the fact that we won't let cars park on the street for any length of time unless they are loading or unloading. Now whether the problem is going to solve itself or whether we must start thinking about the municipality's augmenting the relief by some of the things we have heard lately, I don't know.

Chairman Phillips: You would say Philadelphia's success was

due largely to the fact that you have forced the cars off the streets and into parking places?

Mr. Transeau: Yes, and to a continuous study in view of changing conditions of what was a reasonable length of time for parking in any given area. We have no parking in some areas and in other areas permit parking as long as two hours. At one time there was no parking whatever on Walnut Street, but the merchants got that changed to allow one-half hour parking.

The way it works today we are getting along fairly well, but I think that is due to the fact that a number of people voluntarily tore down their property and set up parking lots, resulting in a decrease in parking cost, greater extension in the parking lots, and a feeling on the part of the public that it is cheaper to spend ten, fifteen, or twenty cents than to take a chance on a fine or getting a fender bumped.

I understand from Mr. Oppermann that he is recommending that we consider parking facilities whenever we plan a new development. We certainly ought to take that into consideration in the use of new territory and zone it at the time to provide proper off-street parking. However, that does not answer our problem in the older cities.

Chairman Phillips: Is your Planning Commission trying to do anything about that?

Mr. Transeau: They have not had much to say about it. The City Council got alarmed at the great number of buildings being torn down and passed an ordinance that in the future on certain streets no more sidewalk crossings were to be permitted. It was an attempt to lessen the number of buildings being torn down by property owners to establish parking lots. However, there was so much protest received that it hamstrung the ordinance very greatly by reducing the number of streets affected, and so there is still an increase each year in the number of parking lots.

So far as the city administration is concerned, all they have done is to attempt to utilize a very large parking lot located five blocks from the city hall. There is a tremendous acreage there and the Mayor had the idea that a deal could be made permitting a man to park his car there and get a free ride on the subway or the bus, but so far that has not worked out. I don't know why; perhaps the P. R. C. would not cooperate.

That is another thought for off-street parking—the provision of free transportation to the place you really want to go.

CHAIRMAN PHILLIPS: That has considerable merit. Mr. Koester, do you attempt to plan your new districts to provide for off-street parking?

MR. KOESTER: We are making a study of it but have not taken any action on it yet. However, we do have a Zoning Commission.

CHAIRMAN PHILLIPS: Would you say it is becoming standard practice to consider such things in any of the American cities with which you are familiar?

MR. OPPERMANN: I would not say that it is standard practice yet, because it does not amount to that much, but there is a lot being done in a few cities in the direction of control under zoning. For instance, Cincinnati has amended its zoning ordinance to provide for the control of parking areas on the border of a business section where there is a transition to a residential section, and parking areas are being located there after the Board of Appeals has had a chance to take into consideration all of the factors involved, including the feeling of the residential population.

Some other things which are happening under zoning I think have some bearing here. You were speaking a moment ago, Mr. Koester, about zoning for off-street loading. Well, the off-street loading zone has a good deal of value. It is being provided in Denver under the zoning ordinance which requires, in the A, B, and C commercial districts, that all loading be in the rear of lots wherever possible. Of course, there are some places where that is not feasible.

CHAIRMAN PHILLIPS: I can speak for the small cities. We have planned in our small city for taking into consideration the future traffic as we see it. That is rather difficult for any of us to do. We are a very old city, and we suffer from narrow streets in the business district. And, while we are not large, we have the same problem in our limited area that you find in the larger cities. We have had a great deal of difficulty in educating our public to the fact that they must expect to do the same thing in parking in Meadville as is done in other cities. The public seems to have the idea that they can get closer to the center of action in the home city than anywhere else in the world, and I imagine that feeling is more or less standard.

MR. MATSON: I think that is true and particularly manifest in the small rural community on Saturday night when everybody tries to park in front of the barber shop. However, there is one significant

point that I think we should take up, and that is the economics of the situation. Both Mr. Oppermann and Mr. Transeau brought out that there has been a very marked trend toward the demolition of buildings primarily for the purpose of parking facilities. Now, let us investigate why these buildings are being torn down. It is apparent to everyone who has thought about it, but Mr. Transeau made a point that I thought was particularly pertinent in the whole thing. Tearing down the buildings created so much competition among the parking facilities available that there was a lowering of rates. I think the economics of the situation, if investigated, will show that most of the valuations placed on properties in central areas in those vicinities where parking is demanded are so great that the revenue which can be obtained from parking can never bring in a suitable income for that valuation. At least that is true in the higher class territories.

On the other hand, with proper control of the situation it is surprising what results can be obtained. Any of you can figure out for yourself what parking facilities can be created for a nominal sum if you go in for a two- or three-deck arrangement. For that sum you can bring back a suitable economic return on the investment. A twenty-five-cent fee will yield a considerable amount of revenue. Apropos of that point, there is another point I would like to make.

This demolition of buildings which has been going on has been rather uncontrolled and I believe that is illustrated in the Detroit and Philadelphia situations. I frankly would like to raise the question whether it would not be advisable for the public officials, the government of the people, to set up reasonable regulations which will control the type of demolition and construction which will serve for a long time and which will be economically sound. I don't believe it is good management to tear down buildings willy-nilly without control, and then when good times come back, which we hope they will, start constructing buildings willy-nilly without some consideration of the terminal problem. A casual investigation of that matter has led me to believe that the wheels within wheels that exist in central districts are so complex in their mechanism that, if left to themselves, I question very seriously whether we will ever develop a sound form of terminal facility for our automobiles.

Chairman Phillips: We should have more planning in the existing district, is that what you mean?

Mr. Matson: Yes, you raised a very good question there when

you said more planning in existing districts. I think all too frequently there is a general belief that planning is nice stuff, but who is going out to the plains and build a new town? I honestly believe that we can have a tremendous amount of planning, and planning that calls for more ingenuity, in the communities where we have to live and work and where we have already a tremendous investment.

As a practical type of development, I cite for example the parallel case in mass transportation in large cities. When our old horse cars or surface cars began breaking down there was set up, after a period of experimentation, a transit commission which was given very definite authority and very definite powers to do something about mass transportation.

We have another parallel case here in the City of New York and particularly in the Hudson River crossing where we have the Port of New York Authority set up by an interstate agreement between New Jersey and New York. That authority was given very definite powers to do something about the movement of commodities and passengers across the Hudson River. So, whenever we have a problem of such magnitude, affecting so many different interests, as I believe this parking problem does, I am led to the conclusion that we are probably going to have to do the same thing with reference to our terminal facilities—that is, to set up a central parking commission or a traffic commission, or whatever you want to call it, some group with the authority to say to a group of owners or managers, or operators in a central district, "Look here, you can't use all of our streets for the conduct of private business."

Chairman Phillips: That is right. I think that that brings us to the question of the proper use of the streets.

Mr. Matson: If such an authority is set up, it can say to the small business man and the big business man, "We have the power to do thus and so about your terminal facilities, and so we suggest that you get together and satisfy your demands to your own satisfaction. If you do that, we will let you work this thing out on your own volition. However, unless you do this by a certain time, we will have to step in and satisfy the public demand and in that instance you will probably have to pay the bill."

That is probably theorizing a bit and getting ahead, but that is the way I think it should grow. I think we have fooled around long enough, leaving everything to private enterprise. It is time for the city officials or some proper agency within the congested area to take

a definite stand on the parking problem in its entirety from the public viewpoint. At the same time that group must, I believe, think of that capital structure which exists, in an effort to preserve and maintain the values already in existence.

CHAIRMAN PHILLIPS: But, the enemy of that sort of planning is the fact that so much of our traffic legislation is a matter of expediency and designed under political pressure. Isn't that true?

MR. KOESTER: That is true; probably more so in the larger cities than in the smaller cities.

CHAIRMAN PHILLIPS: I take exception to that remark, having been subjected to plenty of political pressure.

MR. TRANSEAU: I would like to make a point here. In the first place, we as administrators in large cities are confronted with a conflict between those who want to move and those who believe that it is vital to their business to have a lot of parking at their place of business. The city administration is in the position of trying to keep a balance between the motorist and the merchant, and while I agree with everything that Mr. Matson said, I don't see how you can bring it about in view of the general public indifference to the problem.

For instance, in Philadelphia there is a department store that has blocked two principal streets to the extent where it is really a problem. The city tried legally to break that up and it was pointed out that there was a flaw in the ordinance with respect to loading by backing up to the door with immense trucks and the Council said, "We can't afford to offend those business people as they are heavy taxpayers." We have got to make those people see the light. We have got to make all those conducting businesses see that it is to their interest that the public be able to move expeditiously through the streets.

MR. OPPERMANN: I think there would not be any question, if the facts were available about traffic congestion in the central district, that almost any amount of money would be justified in solving the problem. I know they figure that in a year the loss of time alone in Detroit in the central business district would justify a capital investment of one hundred million dollars for revamping the central business district to make it possible for cars to get in and out easily. That is a figure thrown out at random and I don't know how accurate it is.

CHAIRMAN PHILLIPS: It is hard to get such figures into the tax rate, however.

MR. OPPERMANN: I am fully aware of that and a figure of that kind would not mean very much to the public, but I feel that the only way that the traffic problem can be solved is by taking a look at the whole situation. First of all you have got to bring about a balance between the public and private carriers. We know very well that the streetcar is a much more efficient carrier than the automobile, and also that people do not like streetcars as well as they do buses. And with the new big type of bus coming in, carrying seventy and more passengers, there is a possibility of increasing the efficiency of our public carriers and carrying more people into the central business district in them instead of by private automobiles, which carry 1.7 persons whereas a bus carries ten or twenty times that many.

To revert to the traffic survey again, that sort of information will help in this way too. The origin and destination count will show where people come from, where they are going, and it will give some clues as to the routes and terminal facilities. Further than that it will show what proportion of the traffic going into the central business district has a reason to go there, and what proportion is going some place else. That brings in the by-passes. If we can see to it that more traffic that has no reason for going into the business district does not go there, we will reduce the number of cars we have to deal with on the city streets.

CHAIRMAN PHILLIPS: That reminds me of an argument I had with some of our own merchants recently. They had designed a very loud noisy traffic sign which they put on the by-pass routes to tell the people where our community is. I did everything I could to spike it and I finally did succeed in having that corrected.

Mr. Koester, you come from a smaller city than these other men and I want to see if you agree with me. Who do you think should be permitted to park on the street at the present time until we can educate our public to the fact that we must spend some money for parking lots, etc.?

MR. KOESTER: I would say those entitled to park are those doing business in that area. A survey in Wilmington recently showed that a great many of the store and shop owners and their employees were hogging the parking spaces for long periods of time and

averaged as much as three and one-half hours on the main business streets.

CHAIRMAN PHILLIPS: Did you have a limit for the length of time one could park?

MR. KOESTER: That was in a one-hour parking limit zone. After we made a study of the matter we sought some means for correcting that and tried to put in parking meters to time the motorist automatically when he parks. Our directors felt the elimination of this undesirable parking practice would do away with the jockeying when the cars were marked by the officers, as well as the friction between the officers and the parking motorists which sometimes went to fantastic lengths, you might say. We also felt that the parking meter would give assistance to the officers in timing the cars and would be a check upon the officers as to the enforcement of their duty. Of course, the matter of revenue entered into the picture to a certain extent and sufficient revenue is derived from the meters at the present time to pay for all of the cost of supervision.

CHAIRMAN PHILLIPS: Have they done the job you wanted them to do?

MR. KOESTER: In our opinion they have done an excellent job. Cruising has been practically eliminated on the streets where these meters have been placed. Market Street, the principal street in Wilmington, showed a decrease of 30 per cent in the number of cars moving on it and we figured that that was practically all the cruising that went on at that time, whereas in a parallel street in the same section traffic increased between two and three per cent. It was also felt that there is a trend to place the cost of municipal supervision of any activity directly upon that activity if it can be done. It was pointed out that there is no reason why the small property owner living on the very outskirts of the town, and paying a real estate tax which goes into a general fund, should be made to pay for parking supervision on Market Street when he might not even own a car. So, our directors felt that this direct revenue would pay for the actual cost of the supervision, and that is a good argument in favor of the meters.

CHAIRMAN PHILLIPS: One of the few things that has stirred up a regular hornet's nest is the parking meter. We faced the parking meter question some time ago, and I think we were one of the

first, and perhaps the first to install them. We were fearful of the reaction to them at first and so we proceeded through the Chamber of Commerce. We had them ask for parking meters rather than have the Council attempt to put the idea across. So, they came to us with a petition and we installed as a trial about four blocks and a half of parking meters in the heart of our business district. As I said, we were a little fearful of the reaction and so we put them in on a three-month trial basis. At the end of the three-month period we held a public hearing and invited everybody to attend who had anything to say about the meter system. There were only four people present at the meeting, two of whom spoke.

We have had no trouble since and those meters are doing a job that we never succeeded in doing before. Our public is very much pleased with the parking meters and the merchants are pleased with them. We have had as many as seven turnovers in one place in one hour, and that is what we are struggling for—turnover at the curb.

In the smaller cities I might also say that it has eliminated the double parking problem, because there are enough spaces open at nearly all times to permit a truck to pull in for unloading purposes if there is not a rear entrance. We are enthusiastic about the parking meters because we have no trouble and the political effect of it is good rather than bad. I would caution anybody interested in parking meters against going into it too deeply at first, as it is better to have too few parking meters than too many. There is nothing more ridiculous than a long line of parking meters with no use for them.

Have any of you had any experience with parking meters?

Mr. Koester: We made a number of studies of these parking conditions before and after the meters were put in and I have given to the members of the committee several blueprints which indicate the number of meters included in these counts and the results. There are too many figures on here to read, but I shall be glad to distribute the few copies I have available if anyone is interested in seeing it. These figures seem to indicate that theoretically the motorist on the average has an opportunity to park in one of four spaces. In other words he has a chance to occupying one of every four spaces for a period of thirty-four minutes without payment of the customary initial fee. Those figures are peculiar to Wilmington and the survey would be changed to some extent in other cities, but that gives you an idea of the transition from a city that was

bothered with cruising and double parking and other related evils to a very well regulated one.

Chairman Phillips: I think our experience has been very similar to that in our parking meter experiment. The turnover has been very helpful and a great many people use the meters without paying. We find that the legal parker is a short-time parker in our community. It is the illegal parker who wants to stay all day. If he is going to stay a full hour or longer than an hour he will stay as long as you will let him.

We also found that merchants were bringing their cars downtown and parking them in front of their stores and taking a chance that the police officer might lack the nerve to do the thing he should do. However, with the meter plan, every pedestrian up and down the street becomes an enforcement officer. It takes a lot of nerve on the part of the motorist to leave his car parked with the arrow down.

Mr. Koester: Have you had any test on the legality of the meters?

Chairman Phillips: No, we have not. I understand that our solicitor's opinion in the matter is that it is legal to charge a fee that is to be used wholly for the regulation of traffic on the streets involved, and that is the position we take.

Mr. Oppermann: There are a number of court cases on the matter already and the majority of them are favorable.

Chairman Phillips: I think that is true.

Mr. Matson: I would like to ask one question about the parking meters. I have not had any experience with them but I have observed them. What becomes of the merchant and the other long-time parkers who used to park in front of the store, but no longer find it expeditious to do so? What becomes of their vehicles? Do they quit driving or do they put them in garages, or do they park them on other streets?

Mr. Koester: In Wilmington our experience has been that they leave the cars at home unless they have actual use for them, as the police have been very active in the enforcement of the hour parking limit on the streets adjacent to the meter area.

Mr. Matson: Then it does tend to discourage the use of the automobile?

Mr. Koester: Yes.

CHAIRMAN PHILLIPS: I would say that it does almost everything: it tends to keep certain cars at home and it has extended the parking. It shoved it out over a larger area, and it has to a considerable degree kept cars off the street and at home, and that is something that should be discussed. We might not have time for it today, but there is a lot of meat in the possibility of keeping most of the cars at home when they are not going to be used. If a greater number of owners would do that it would go a long way toward solving our parking problem.

MR. MATSON: It might go a long way toward solving the parking problem, but I think it would be a step backward in transportation. I think the American public would put up with it for a while, but eventually they would start demanding again the full and unrestricted use of their automobiles.

CHAIRMAN PHILLIPS: You don't think we would have solved any problem?

MR. MATSON: I don't think so. I think you will find automobiles are used in all groups of society; you will find them from the wealthy homes all the way down to the workers on the W.P.A. jobs.

MR. KOESTER: It does result in decentralization to some extent. It discourages the use of centralized storage space and forces it out farther. Isn't that right?

MR. MATSON: I don't know.

CHAIRMAN PHILLIPS: I wonder if any of you gentlemen have had any experience or found a solution for the special privilege parker. I think every city has him and every city government permits him to some degree.

MR. TRANSEAU: We make them pay for the privilege.

CHAIRMAN PHILLIPS: Who is the special privilege parker?

MR. TRANSEAU: Well, prior to 1932 or thereabouts it was possible for practically anyone who was respectable to get from the police department a couple of loading zone standards which they placed in front of their place of business or residence if you like. When this work was tackled on an engineering basis we started to investigate who got these signs and why. In other words, from that time on we would not grant them except to people who had some good reason for them, a physician or someone like that, or a merchant who actually had to use that particular space. The signs were not very successful, however, because so many of them had

been granted previously that nobody respected them. I believe there were nearly two thousand of them at one time. Well, the city council in its wisdom started to charge for them. We called in all the ones that were out and set up a fee of twenty-five dollars the first year and ten dollars for each year thereafter. So now I don't believe there are more than three hundred or three hundred and fifty of them issued. When they had to pay for them they decided that it was not worth it.

CHAIRMAN PHILLIPS: Do you think such practice would stand the test of law?

MR. TRANSEAU: I don't know if it was actually tested but we were informed that it would. The ordinance was prepared with the help of the city solicitor.

MR. MATSON: I think it is legitimate to charge a fee so long as it is in line with the actual cost to the city of investigating whether the conditions warrant a zone, the cost of the zone, and the maintenance of it.

CHAIRMAN PHILLIPS: I think that would be the same general condition under which parking meters might be legal.

I am sure we are having a very interesting discussion, but as we are nearing our closing time I think we should give the audience a chance to ask questions. Are there any questions that you would like to ask?

MR. E. L. HUDSON (Minneapolis, Minn.): From a parking meter standpoint, suppose that you had a business district with parking meters and then just adjacent to that you had a residential district, and a large number of people were driving down to the adjacent residential district and parking their cars, would you be creating a parking nuisance in the residential district?

CHAIRMAN PHILLIPS: We faced that same thing in our community, but we do not feel that the man in the residential district owns the street any more than the man in the business district. In other words, having cars parked in front of residences is no greater nuisance than having them parked in front of stores. We answered our public on that basis. The whole community uses the business district of our town and every other town, but the whole community does not use the area in any one given residential district, so we feel it is more in the public interest to keep traffic properly maintained in a business district than anywhere else, but we do not think

we are doing any injustice or committing a nuisance by permitting them to park in the adjacent residential district, as they have always had that privilege before.

Mr. Koester: In Wilmington there is no clear definition between the business district and the residential district. They merge one into the other. As a matter of fact those residences near the center of the city are already troubled with congested parking, and they have trouble getting to their own homes even now. The metering in the center may push them a little farther out, but in a city the size of Wilmington, where you can go from any home within the city limits to the business area in fifteen minutes, it means that when they have to park a certain distance from the business area a number of them will leave their cars at home.

Mr. Oppermann: I would like to say a word for the home owner. I think the people who live just outside the business district of a city have a right to a certain amount of privacy and that by crowding cars into that section you are not only going to deprive them of that, but I think it will have a detrimental effect on property values. I think it is a responsibility of the central business district as much as possible to take care of the cars used there and if they cannot handle the situation, they should not throw it back on the surrounding areas. As you know, some of them who are at the point of transition between the central business district and the residential areas are having a hard enough time as it is maintaining property values and inducing people to use the property and get some income out of it.

Chairman Phillips: I think you have got something there.

Mr. Transeau: What about the apartment houses in the residential district and the moving picture theaters?

Mr. Oppermann: Well, in the City of Los Angeles and Riverside, Illinois, a big city and a small city, all apartment houses are required to provide space for one car per family on the property. I don't think it is any more than right that the developers of the property should take care of cars and not burden the surrounding property owners.

Chairman Phillips: You are referring now to places where that can be done.

Mr. Oppermann: That is right, you cannot have any retroactive ordinance on that point that would stand up.

Mr. Hudson: I agree with what has been said, but I have taken

the stand in my district that every moving picture house should provide parking space, and out of five moving picture houses we have four of them that have provided parking space and up to date you can't get a moving picture license unless you first show you can provide parking facilities.

MR. KOESTER: Is that for all of the patrons?

MR. HUDSON: Yes. We have passed an ordinance to that effect, and we are now working on the old theaters to try to get them to create enough parking space to take care of their patrons.

I would like to ask a question. Has a city or a community any right to set aside loading spaces and prohibit other people from parking in that particular space without first charging a fee?

MR. TRANSEAU: That loading zone is open to anyone who has to load and unload.

CHAIRMAN PHILLIPS: We cannot set aside a space for anyone on a city street at any time. We do put up the signs and tell the specially privileged person that he has to take his chances. We frequently have had people park there and stay parked.

MR. HUDSON: You don't tag them?

CHAIRMAN PHILLIPS: No.

MR. MERRILL (South Orange, N. J.): In those communities where you have the parking meters, do you have in the vicinity a free parking space in an off-street area for those who formerly parked on the street?

CHAIRMAN PHILLIPS: Not in our community because we do not have any space available.

MR. KOESTER: The City of Wilmington does not have any parking space available. All the off-street parking space is privately owned.

MR. OPPERMANN: There is a trend toward municipal parking lots in a number of the states and I believe seventeen or eighteen have them. They are free parking lots and the only one I know of that charges is the one in Chicago where they charge twenty-five cents for twenty-four hours. They have a lot there on the lake front that is extensively used. There is space for 2,500 cars, which is now being enlarged to take care of 3,500. In some cities the municipality provides several parking lots scattered around the central business district. One very important advantage of that plan is the control of the city over that property, and the fact that permanent parking areas are created. All of the privately owned parking lots are being

held for business development and there is nothing permanent about them. In other words, if you have a lot that is being used for parking and it goes out of use with the erection of a building in its place, you not only have no parking area, but you have additional people and cars being brought to that same territory for storage. That is a point in favor of the municipal parking lot.

CHAIRMAN PHILLIPS: That brings up a question that we want to discuss—the obligation of the city to provide parking facilities. Mr. Matson mentioned that they are doing some fine work in Schenectady. Is there anyone here from Schenectady? (No response)

MR. MATSON: I don't know if I can review it as well as someone from Schenectady, but it fits in very closely with the remarks Mr. Oppermann just made. The municipality there is taking a definite stand with reference to parking facilities. As I understand the story, it grew out of the proposal of the Housing Authority to create satisfactory housing conditions in Schenectady. As it is a small city they were quick to see that if they created a lot of low cost housing they would seriously disturb real estate values in the blighted areas in the immediate vicinity of the central business district.

After thinking the problem over they came to the conclusion that they wanted better housing for people in Schenectady, but for every additional housing facility which would be created one of the older types should be destroyed. And, in order to make the cycle complete they decided to tear down the area close to the central business district and convert it into parking lots. Of course, the subject of who was going to pay for that work was then considered, as there were tax losses and property destruction involved. As I understand the thing, a proposal has been worked out which has been accepted, or is about to be accepted, to make a three-way division of the cost. One-third of the cost would come from a general fund of the city, one-third would come from operating revenues of the parking lots, and one-third would be an amount imposed on the merchants and other operators in the central district. They all seemed agreeable and willing to take that particular distribution. I think that is a very interesting development.

One of the virtues of such a policy is that you are creating there immediately a rather clear division between your business operations and your residential quarters which has already been brought out through zoning.

That seems to be full of possibilities and I am watching the experiment very closely. Mr. Fisch, the traffic engineer of Schenectady, is working on that and if any of you are interested in it you could write to him for some additional information. To me, that seems like a practical and sound type of development.

MR. HUDSON: Don't you think that Mayor La Guardia's statement that the engineers should leave the traffic control in the police department, should be questioned? I think it should be decided that the traffic engineering should be left to the traffic engineering department and the enforcing of the traffic rules should be left to the police department.

CHAIRMAN PHILLIPS: I don't suppose you insist upon Mr. Matson answering that question.

MR. G. M. SHEPARD (Saint Paul, Minn.): I would like to get some information on the parking meters. In the first place do you use the automatic or the manual type and do they give you any trouble in the winter weather?

CHAIRMAN PHILLIPS: We have had 117 of the automatic type of meter for three years. We paid for them in thirteen months. They are hand wound by the policeman on the beat. We have had some maintenance on them but not very much. I happen to have a statement on the 117 meters which shows we have spent $117.19 in maintenance. We have had a little cold weather trouble with them, but our temperature goes only to about fifteen or eighteen below. I believe we have some of the early meters and they no doubt have been improved since then. However, as I said before, we have not had any major trouble with them. We have put the maintenance of the meters in charge of the meter division of the water department and they take very good care of them for us.

MR. HUDSON: Do you think that eighteen degrees more below zero would have any effect on them?

CHAIRMAN PHILLIPS: I think the colder it gets the more trouble you will have, but I do not think there will be any major trouble.

MR. KOESTER: We have not had any trouble with ours and we have the same type as Mr. Phillips—the automatic. On an average there is one minor repair for every fifty meters per week. It is just some small adjustment that has to be made and takes only a few minutes.

MR. HUDSON: How cold does it get?

MR. KOESTER: About twenty to twenty-five below. It might be

interesting for you to know that about one out of every three thousand coins is a slug and one out of every three thousand coins is a Canadian nickel.

Chairman Phillips: Are there any more questions?

Mr. Weaver (Montclair, N. J.): Is there any reason why one has to use the automatic meters? I believe there is no question but what the manual meters require less maintenance. We have manual meters and we do not have any trouble educating the public to turn the crank whenever they deposit their coin, and there is very little maintenance on them.

Mr. Koester: The argument against the manual meter as we heard it was if a man drops a nickel into the slot and leaves his car there he may fail to turn the handle and then when he comes back he finds an officer there ready to give him a tag. He says, "I put in my nickel," and the officer turns the crank and finds that a nickel has been deposited but the man failed to turn the crank. The officer can not do anything about it, and if that practice were to become prevalent every parker would drop a nickel into the machine and walk away without turning the handle; then when the officer came along he would have to try each handle to make sure that the nickel has been deposited. In that way you are making a meter attendant out of the policeman. Besides, it lets the parker's hour begin at the time the officer turns the lever, whereas with the automatic type the hour begins as soon as the nickel is dropped.

Chairman Phillips: I would augment that by saying that we installed our meters when there was only one meter being manufactured and we had no choice in the matter. What we would do today, I don't know.

The time is getting late but before I dismiss this panel I want to thank you all for making it possible, and express my hope that we may continue the discussion of this topic at the Congress next year.

Allocating Space for Underground Structures

G. R. THOMPSON
City Engineer, Detroit, Mich.

FOR THE purpose of this paper, underground structures will be considered as being those service facilities which are customarily placed under the street surface between property lines. These services are:

1. Sewers, separate or combined
2. Water pipes, both high and low pressure systems
3. Gas pipes
4. Electric conduits, including those for street lighting, power, and communication wiring
5. Heating mains

There are other structures, such as building foundations, building areaways, underground transportation and parking facilities, and large tunnels for water supply and intercepting sewers, which are so highly specialized that they cannot properly be considered under general treatment. However, the probability of the need for such structures should not be overlooked in arranging space for the more usual and common facilities.

If the problem of properly locating the more common underground structures could be reduced to its simplest terms by assuming a static condition of local frontage demand, along the street, and distant demand through the street and beyond, including surface demands for traffic, it would be relatively easy to obtain a correct solution from the ordinary principles of engineering economics and design, for both construction and maintenance.

Planning for static conditions is, of course, purely theoretical since every street is subject to constant change because the property it serves, both local and distant, is in a constant state of change. Such planning, however, has the advantage of developing certain essential purposes which, with reasonable application to estimated future requirements, are of general use.

The following considerations naturally affect the planned location of the underground structures under discussion:

1. They should be at a minimum depth below the surface to serve their purposes properly and to minimize the cost of excavation in construction and maintenance.

2. They should be located so as not to interfere with each other either horizontally or vertically, nor when crossing each other.

3. They should be located so as to provide taps from abutting property and service in public property at a minimum expense in construction and maintenance.

4. Other things being equal, they should be so located as to be accessible for repairs and replacements with minimum damage to surface structures and interruption to traffic.

As an example of the foregoing, there is presented herewith a sketch of a typical cross-section of the main street in Detroit, which is Woodward Avenue, showing the approximate location of various services after widening this thoroughfare from 74 feet to 120 feet. Woodward Avenue carries a trunk-line sewer, which is far below the depth of any other structures and serves no local properties direct. The local sewage is carried by sewers in alleys in the rear of the property.

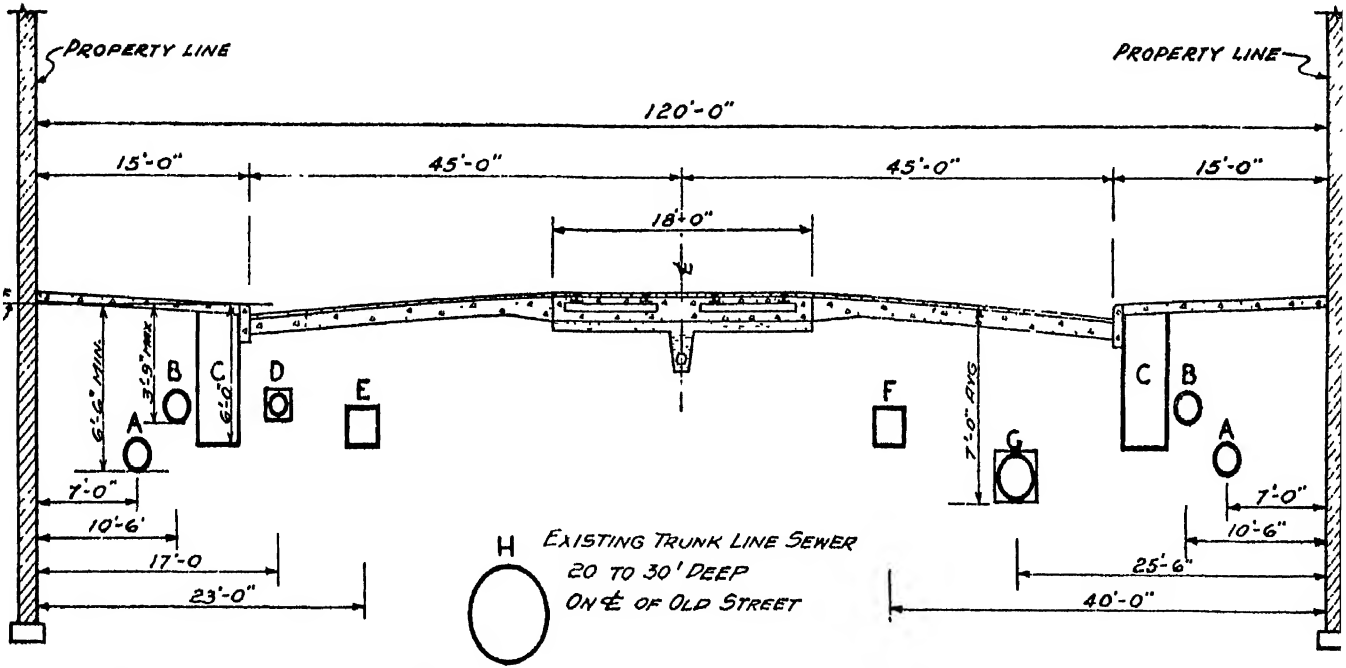
It will be noted from the sketch that the water mains and gas mains have been located under the sidewalk, as it has been found in Detroit that these services require most surface disturbance for general maintenance and for changes in taps.

Street lighting conduits are placed under the sidewalk immediately adjacent to the curb to serve the poles located along the curb lines.

As a result of Detroit's experience in street widening, this arrangement of underground structures will be generally adopted hereafter when major widenings permit their logical location. Credit for this plan is due Laurence G. Lenhardt, who was Commissioner of Public Works at the time of the major street widenings in Detroit.

As street widths have increased because of traffic density, and as heavier pavements have been built for heavy traffic, there is a tendency toward running duplicate services on each side of wide streets, permitting short taps to abutting property, instead of the long taps across the streets which are necessary for single service.

The following table (Table I) for water mains, based upon uniform estimates of construction costs for comparative purposes, shows when double lines are less costly than single lines of water pipe for varying sizes and street widths. For example, an 8-inch



TYPICAL CROSS SECTION OF WOODWARD AVE. — DETROIT, MICH.
AFTER WIDENING FROM 74' TO 120'

single main in a 60-foot street, complete with taps to the property line, can be laid at the estimated cost of $3.37 per lineal foot of street, which is less expensive than its alternate, a double line of 6-inch pipe at $4.25. However, in a 120-foot street the conditions are reversed, as the 8-inch line will cost $4.50, whereas the duplicate 6-inch line will cost but $4.25. It will also be noted from the table that in the case of the 120-foot street, the double pipe in all cases is less expensive than the single, but in the narrow street the saving by reason of the double pipe does not occur until there is a demand equal to that of a 12-inch pipe, where the 12-inch single pipe costs $6.62 as compared with $5.25 for double pipe.

TABLE I. COMPARATIVE COSTS OF WATER MAINS PER LINEAL FOOT OF STREET, INCLUDING SERVICE CONNECTIONS

A—Single main in street serving both sides
B—Main on each side of street serving each side separately

		60-FT. STREET		80-FT. STREET		100-FT. STREET		120-FT. STREET	
A Single	B Double	A Single	B Double	A Single	B Double	A Single	B Double	A Single	B Double
4″...	4″...	$2.62	$3.75	$3.00	$3.75	$3.37	$3.75	$3.75	$3.75
6″...	4″...	2.87	3.75	3.25	3.75	3.62	3.75	4.00	3.75
8″...	6″...	3.37	4.25	3.75	4.25	4.12	4.25	4.50	4.25
12″...	8″...	6.62	5.25	7.00	5.25	7.37	5.25	7.75	5.25
16″...	10″...	9.12	8.25	9.50	8.25	9.87	8.25	10.25	8.25

NOTE: The capacity of the double mains is equal to the capacity of the single main as closely as practical.

Table II is similarly prepared for sewers. In this table a typical run of 1600 lineal feet of lateral sewer was assumed, increasing in size every 320 feet. In the case of the single line of sewer, the "Y"s are extended to within 10 feet of the property line, which is the dividing line of cost between private and public property in Detroit, and in the case of the double line the line is located 10 feet from the property line, and the "Y" connection only is provided.

The sewer increases in depth from 8 feet to 16 feet and is assumed to be built of vitrified pipe in open cut in clay, machine excavated. The average distance between taps is 40 feet. Within the limits of this table, it will be noted that the single sewer is less costly than the double in the 60-foot street. In the 80-foot street, the double sewer is less costly than the single, until the demand is reached for a 24-inch sewer, in which case the single 24-inch sewer is cheaper

TABLE II. COMPARATIVE COST OF LATERAL SEWERS PER LINEAL FOOT OF STREET, INCLUDING "Y"s

A Single	B Double	60-FT. STREET A Single	60-FT. STREET B Double	80-FT. STREET A Single	80-FT. STREET B Double	100-FT. STREET A Single	100-FT. STREET B Double	120-FT. STREET A Single	120-FT. STREET B Double
12″	10″	$2.20	$2.38	$2.68	$2.38	$3.16	$2.38	$3.64	$2.38
15″	12″	2.56	2.74	3.04	2.74	3.52	2.74	4.00	2.74
18″	15″	2.85	3.25	3.33	3.25	3.81	3.25	4.29	3.25
20″	15″	3.15	3.25	3.63	3.25	4.11	3.25	4.59	3.25
24″	18″	3.84	4.54	4.32	4.54	4.80	4.54	5.28	4.54

NOTE: The capacity of the double lines is equal to the capacity of the single main as closely as practical.

than a double 18-inch sewer. In the 100- and 120-foot streets, the double sewer in all cases is less expensive than the single.

Tables similar to those given for water and sewers could readily be worked out for other service facilities. In all cases the figures will vary somewhat, dependent upon soil conditions affecting excavation, frequency of taps, and the desirability of cross-connecting such services as water mains and gas and heating pipes.

The comparative economics for maintenance has not been developed in these tables, although this is an important consideration in which weight must be given to the type of pavement to be disturbed for repairs to the underground structures.

Serious consideration should be given to the carrying of underground facilities, except gravity sewers, in service tunnels, on one or both sides of major streets. In our larger cities, an occasional glimpse of underground construction showing the maze of pipes and conduits constituting the nerve centers of a big city, and a realization of the number of times these have been disturbed for repairs and replacement, makes this plan seem logical. Industrial plants and large institutions have found the placement of service facilities in tunnels desirable, for although this design may be high in first cost of construction, it affords advantages in maintenance, repairs, changes, and non-interruptions to surface conditions, which seem to justify its rather common usage. Problems of ventilation, insulation, drainage, and other design details for each of the various facilities placed in the tunnel would naturally have to be given special consideration. Grave explosion hazards from leaks in gas mains would have to be considered if gas pipes of the present type of construction were placed in tunnels. High tension power

lines might require encasement within the concrete tunnel walls. On the face of it, it would appear that the application of tunnel construction for carrying underground structures would be limited to *special cases,* even in a relatively large city.

Importance of Planning Ahead

Unfortunately for the solution of the proper allocation of space for underground structures, streets are not in a static condition. Narrow trails have become wide traffic arteries. Private property abutting the residential street has changed from suburban to urban occupancy. The underground structures which serve that abutting property must change with its development in use and occupancy. The ability to foresee these changing conditions with reasonable accuracy is the difficult part of this problem. The changes, which we in our careers have witnessed, could hardly have been considered reasonable by our predecessors, whom we are prone to criticize for lack of foresight. The changes that are to come in the future may seem as unreasonable to us. As practical engineers, we must plan for such changing conditions, but without going to the unwarranted extremes envisioned by Sunday newspaper supplements in their city of the future. Our concern is in the present with its lessons from the past, plus reasonable provisions for the future rationalized on sound economic grounds.

Like Topsy, most city streets were not brought up according to a predetermined plan—they rather grew up on the expedient basis of first come, first served in allocation of underground space.

Sewers with their comparatively great depth arrived first underground and usually occupied the approximate center of the original street in order to equalize the length of taps from adjacent private property. Trunk or main sewers continue to be similarly located. Lateral sewers intermediate between private property and trunk sewers are now generally located when possible in the rear of private property, in alleys or easements. Street drainage from catch basins is carried into trunks, where available, or by the easiest method to a lateral. Because of their depth, sewers generally avoid interference with other structures and as they seldom need to be dug up for repairs, their location under pavements or paved alleys is not seriously objectionable.

Water pipes require frequent uncovering for repairs or taps and should, therefore, be located in a readily accessible part of the street

behind the curb line, under grass plots or sidewalks. The duplication of water mains, that is, one on each side of the street, is of particular advantage in business and congested areas, as greater fire protection is given with a looped system, with fire hydrants on each side of the street, fed from both directions. Water pipes must be located below the frost line and their depth must be coordinated with that of gas and other structures so that they will not interfere with each other.

Gas pipes are subject to the most frequent need for uncovering to make repairs and taps and should also be located back of the curb to minimize repair costs, including damage to street pavement and interruption to traffic. The advantage of looping gas pipes, with one on each side of the street, is similar to that gained by looping water conduits to provide a two-way flow.

Electric conduits seem to require less disturbance for maintenance and repair than most underground structures and the changes of cables and conduits can usually be accomplished from splicing chambers. There is little objection, therefore, to placing this group of structures under the street pavement. However, for the purpose of street lighting, these conduits are most conveniently located on both sides of the street.

Heating mains may be considered from the same viewpoint as gas mains, although experience in Detroit indicates that these lines are disturbed less than either gas or water. They should be located preferably behind the curb line, unless placed in tunnels. In many sections of Detroit, the steam mains are located in deep tunnels, accessible for their entire length, and their repair is, therefore, not a hazard to street pavement. Local heating lines are in comparatively shallow trenches, which are occasionally tapped. In all cases the expansion joints which require most attention are in manholes and are readily accessible.

While this subject may be classified theoretically as of utmost simplicity, or on the other hand as one of infinite complexity which is impossible of accurate solution, it is evident from costly experience in permitting hit-or-miss planning in the past that something should be done about it in a forward-looking commonsense way.

I have been informed that in one city in Michigan, with a population of 65,000, a private service corporation estimates an expenditure of over two million dollars for lack of proper planning of allocation of space. The writer has obtained no figures from other service corporations in larger cities, but on a comparative basis from the

above example, the cost due to improper planning of underground services must be enormous. That these costs are borne by the utilities is no excuse for their unnecessary incurrence, because in the final analysis the consumer must absorb them.

Aiming at the best solution possible as a practical consideration, it would seem that two things are necessary:

1. Proper planning for the present and immediate future, together with rational provision for the distant future, and

2. Control of the situation to see that the plan is adhered to or modified intelligently.

The Proper Planning Agency

So far this paper has discussed factors of design affecting the formulation of a plan. Before leaving this phase of the subject, consideration should be given to the proper planning agency. I believe the proper agency is the city engineer. This at least is true in Detroit, where the city charter places the control of streets under the jurisdiction of the commissioner of public works, with the city engineer as his assistant on all matters pertaining to engineering. Naturally the engineer will confer with other interested parties, such as the service corporations, both public and private, which utilize the street, and will not overlook planning boards which coordinate all phases of city development.

In the matter of carrying out the plans, it would seem logical that the city engineer have control of the consummation of the plan which he has prepared. To make this effective, underground records must be kept as lost information comes to light in various street excavations. Street excavations must be controlled by a permit inspection system. It is a charter provision in Detroit that no street may be opened by any public or private organization which has not first obtained a permit from the city. This serves as notice to our permit inspectors that an opening is to be made and they get on the job to see that the excavation is properly backfilled and the street surface replaced. This also gives them an opportunity to record underground observations. It is, of course, desirable that pavements be disturbed as infrequently as possible. A penalty clause on openings within a short time after paving serves as an encouragement to abutting property owners to have their taps made before paving takes place.

It is the practice of Detroit at the beginning of the year to give

notice to utilities as to contemplated construction. The charter provides that three times the value of paving repairs may be charged for cuts during the first year of installation; two times the value for the second year, and normal cost thereafter.

To summarize this subject, it may be said that it is of so general a nature that no specific plan applicable to all conditions can be laid down in the field of design. There are certain generalizations, however, which are applicable. Past procedures, without centralized control of planning, that have led to chaotic underground conditions, can be remedied by establishing a centralized agency to deal to the best of its ability with underground conditions as they exist, and may exist in the future—and this agency must control the carrying out of its directions. Furthermore, the development of an underground map of street conditions is a necessary point of beginning in the problem of allocating space for underground structures.

DISCUSSION

S. A. Sagrario

Engineer in Charge of Underground Construction, Public Service Corporations, Washington, D. C.

Mr. Thompson's excellent paper has emphasized what Washington, D. C., recognized thirty years ago—that subsurface structures must be planned in advance, and must be installed along prearranged lines.

In July, 1908, the Commissioners of the District of Columbia created a Board of Underground Construction, Public Service Corporations, which is at present composed of the Director of Sanitary Engineering, the Director of Highways and the Director of Inspection. The creation of this Board has resulted in the designing of a systematic method for the extension of underground construction, including sewer and water lines, with a view toward the greatest possible conservation of public space.

With city traffic as heavy as it is today, endeavor has been made to locate subsurface structures so that when repairs or replacements of them are necessary a minimum of inconvenience to traffic will result. Because of the heavy concrete foundation now found necessary in roadway construction, an attempt also has been made to locate back of the curb those subsurface structures which require

more or less frequent digging up. Space lying between the property line and the inner edge of the sidewalk was at one time seriously considered for the location of underground construction; but such location did not find favor because of the copings, retaining walls, terraces, hedges, flower beds, and other interferences encountered.

Sidewalks are marked off in blocks 3 feet square, and those structures to be located thereon are, as far as possible, aligned in the center of these blocks. This practice results in minimum damage to the sidewalk and incidentally reduces the cost of restitution. No patching of blocks is permitted.

In connection with the installation of underground construction, study is given to all plans for proposed extensions, to insure their conformity to established zoning plans. These structures include telephone, telegraph, electric light and power; steam, oil, and gas mains; tunnels, vaults, and fuel oil tanks, and privately owned conduits and pipe lines and all other structures in public space, including the city cables, municipal sewers, and water mains; and, to a degree, the plumbing work connected thereto.

The section which has charge of this work prepares all permits for such underground structures, except for sewer, water, and plumbing, and incorporates therein such construction procedure conditions as are necessary. In addition, careful study is given those applications for permits which necessitate the cutting of improved roadways laid within the decade antedating the applications—with the view, of course, of eliminating such cuts, if possible. All permits for the cutting of roadways are passed upon by the Director of Highways, who, except in the event of emergency, is authorized to refuse a permit to cut a pavement within two years after it has been laid.

During the installation of utility structures, inspections are made for compliance with the conditions of the permits, and field-book sketches are prepared, showing detailed measurements of the new work as well as of old structures encountered in the excavations. It is, however, sometimes necessary to adjust complications arising during construction.

In connection with the paving programs carried on by the Highway Department, the section in charge of underground construction makes recommendations on all paving schedules as to the necessity or desirability of introducing new underground utility structures in the streets, alleys, or sidewalks prior to the paving. As this office

maintains contact with the officials of the various utility companies, it frequently renders material assistance to the Highway Department in the matter of obtaining prompt releases on paving schedules and in inducing the different companies to start their work in sufficient time to avoid interference with paving operations. Similar studies are made to accomplish the installation of necessary sewer and water lines in advance of paving work.

There are probably few cities in the United States which have so complex an installation of subsurface construction as has Washington, due primarily to the fact that all overhead wires, within fire limits, have been prohibited since 1897 by an Act of Congress.

The inspection fees are of necessity modified from time to time, but in general they have been unchanged for the last twenty years. In Washington the gas mains most frequently installed are of 4-inch and 6-inch diameter; the size of conduit most frequently installed is 4-duct. Under the method of computing charges, the inspection fee for each of the above sizes is two cents per linear foot; for a 16-inch main or 16-duct conduit the charge is four cents per linear foot.

Regulations require that an application for a permit be accompanied by an adequate plat showing the proposed installation. No trouble along this line has been experienced from the public service corporations. However, with the advent of fuel-oil tanks, most of which are installed by concerns employing no drafting force, considerable difficulty was experienced as to this plat requirement. Three dollars is the normal charge for inspecting such installation; but it was deemed expedient to adopt a sliding scale up to ten dollars, the size of fee to be determined by the amount of work required of the city's officials in fixing a proper location. This sliding scale apparently had the desired effect, for since its adoption adequate plats have been the rule rather than the exception.

There is one question which Mr. Thompson did not touch on and to which I would like to get an answer, and that is one pertaining to transformer manholes. The size of these manholes has been growing from year to year until at present the standard size is 4½ x 17 feet inside dimensions, with walls varying from 8 to 12 inches.

What would be a fair charge for the privilege of occupying so much public space? Should there be a yearly rental charge based on the assessed value of the adjacent land, as is now being made for

large private vaults, or should there be merely an increase in the existing inspection charge? The present charge is one dollar for a permit and two dollars for inspection. It may be that some of you gentlemen have had to meet the same problem and I would certainly appreciate any suggestion you might make toward an answer.

Thomas Buckley

Assistant Chief Engineer and Surveyor, Bureau of Engineering, Surveys, and Zoning, Philadelphia, Pa.

The person who coined the expression "out of sight, out of mind" may have been thinking of underground structures. Certainly many of our citizens, and even administrators, appear blissfully oblivious to subsurface requirements and conditions until some related physical fault, failure, or want, jolts them into consciousness of such matters. The taxpayer who suddenly receives an excess of water in his basement from a broken main, or whose barn burns down for lack of adequate water service, and the residents within an area repeatedly flooded by torrential rains too heavy for existing sewer capacities, represent the class of laymen most likely to take an interest in underground structures. While such interest, when sufficiently aroused, may become a driving force for underground betterment, it is not deeply concerned in the problem of allocations.

Consideration of this problem must come from within. It is the sole responsibility of administrative heads whose disposition too often has been to continue a policy which tolerates the laying of utilities in a manner most convenient for the moment and thereafter forgetting about them until something happens. On the other hand, those engaged in the placement and maintenance of public utility underground services, those charged with the construction and upkeep of subsurface facilities—other than public service utilities—realize fully the practical and economical advantages to be derived from an effective control over structural locations beneath the surface of public highways.

The necessity of such controls, therefore, has been accepted as a live problem in public works engineering and technical interest in this subject has become increasingly constructive during the present decade. Examples are: the work of the Committee on the Location of Underground Structures, of the A.S.C.E.; the Specifications for

Mapping Underground Structures, of the A.P.W.A.; the activities of the Committee on Subsurface Structures of the A.R.B.A.; the cooperative work done by certain public utility technical committees in various cities, and the featuring of this subject at such technical meetings as the present one.

As one of the leaders in the discussion of Mr. Thompson's paper, it is my task to hold up before this meeting those highlights in his presentation which, in my judgment, prompt open discussion at this time.

The title of Mr. Thompson's paper suggests a planned procedure. Such procedure, if kept within the limits defined by the speaker, we endorse. For subsurface planning, the A.S.C.E. Committee recommends the development of plans for the location of underground utilities as an adjunct of each city and regional plan; that such plans should be developed to care for the needs of five future years and be revised from time to time to accommodate changes in zoning, in the master street plan, and in any other controlling conditions.

Underground planning for the present and near future is imperative but long-range planning, as Mr. Thompson points out, may be mainly theoretical. The physical structure of our city is indeed never static. While such controls as city, master, and regional plans and zoning have to some degree stabilized the general character of certain streets, such fixings are limited in extent and far from permanent.

Moreover, the major portions of the corporate areas of most cities are completely built upon. Underground services are in place but too often in uncharted positions occupied for many years. Planning allocations in these areas, therefore, will be largely confined to extensions and replacements and to determining the remaining space available for additional allocations creating minimum conflictions with existing structures.

Obviously there can be but a limited standardization of allocations in such sections. Use districts are conglomerated. Variations in structural diameters of services such as ten inches to twenty-five feet for sewers, four inches to five feet for water, two inches to four feet for gas, and vaults and overhead service and underground transportation complicate the problem. The necessity of relief and intercepting sewer construction may also become a factor. Streets adjacent to power, pumping, and terminal plants and arterial

highway intersections are not favorable for standard allocations. However, streets opened or widened in built-up areas or affected by grade separations, and all viaducts and approaches, may be so planned.

For these reasons, planning for underground structures in advance of their actual need, including allocations of definite space to specific utilities, is best administered in new, undeveloped, or in suburban and rural districts. This planning is very strongly recommended.

The four factors mentioned by Mr. Thompson as affecting locations, i.e., economic depth, freedom from interference, accessibility of connections, and efficient maintenance, are of basic importance and apply with equal force to all allocations of space.

In considering allocations, allowance must be made for local practices and distinctive street characteristics, but since the patterns of all large cities are pretty much the same, there is bound to be some degree of similarity in the standards adopted by them. The influence of local characteristics on the allocation of underground space may be illustrated by conditions in Philadelphia. The bulk of the thoroughfares in central and subcentral city are but 50 feet wide. These streets are solidly lined with buildings without setbacks; sidewalks are 12 feet wide and steps and other appurtenances are permitted to encroach 4½ feet upon them. Pole lines, hydrants, valves, vents, trees, etc., occupy a strip about 2 feet wide in back of the curb. There are 3,400 vaults in the city, the majority of which are in this section, and these extend either to, or within, 3 feet of the curb line. Many of these streets contain a single line of street railway tracks. Lack of space between curb lines made it necessary to locate utilities within a limited sidewalk strip. Two important results of such allocations were: in lieu of the corner inlet, which had been used whenever possible, the use of two house line inlets was necessitated, and special regulations had to be designed to preserve the standard survey monuments placed in sidewalks on a 5-foot range or offset system.

The economic and practical advantages of dual services in the opposite sidewalks of wide streets have been clearly stressed by Mr. Thompson. Other factors, beside width, are excessive traffic, street railway lines, single or multiple oversized mains and even hard rock at or near the surface of the ground.

The use of tunnels for carrying underground services demands a

very careful approach. Such practice has been discussed for many years but, to our knowledge, never adopted for extensive runs. The confining in proximity of water, gas, telephone and electric lines of low and high tension might create serious potential hazards. The addition of steam or heating lines in such tunnels, under certain conditions, would be ruinous. The tunnel encasement, including junction chambers, multiplicity of openings for property connections, together with effective insulation, drainage, cellular protection and ample facilities for ventilation and overlapping maintenance, would add greatly to costs. Spreading first costs and upkeep of such tunnels would present interesting problems. Credited against these items would be the marked economy in paving costs and the advantages to traffic.

The suggestions made by the speaker for determining specific allocations are based on experience and sound practice and no further comments are necessary at this time.

The lack of rational planning and zoning has laid heavy burdens of additional costs on the taxpayers as such as well as upon utility companies. If all future underground construction could be done in accordance with a wisely conceived plan and be subject to an effective control, great economies would result. Time will not permit a discussion of the form of planning agency recommended by the speaker. However, Mr. Thompson and I speak the same language with respect to the chief engineer.

In conclusion, I mention the fact that Philadelphia has had a continuous control over the location of underground structures since 1884; and that the administration of this control has become increasingly efficient through the cooperation of the local Utilities Technical Committee, created during the interim of 1924-1926.

Control and Regulation of Pavement Cuts

CHARLES E. BROKAW
Superintendent of Highway Maintenance, Cincinnati, Ohio

IN THIS article the writer will attempt to point out an effective program for the control and regulation of pavement cuts, as the result of his experience with this perplexing subject while in the service of the City of Cincinnati.

It is a generally recognized fact that in most public works departments the policy concerning street openings may be productive of more ill will than any other function. For this reason it is incumbent on each public works department to adopt as rigid a set of rules and regulations governing openings as local conditions permit.

The first and foremost item of control should be the requirement that no opening may be made in any pavement, sidewalk, or right-of-way within the city limits without the authority of a Street Opening Permit. For the most efficient administration, these permits should be issued by a responsible employee delegated by the director of public works, upon receipt of a written application filed on a standard form in the designated clerical or records division of the department.

These Street Opening Permits should be issued on standard forms on which space is allotted for the following information: permit number, date, name of permittee, location of proposed opening, kind of pavement, length and width of proposed opening, purpose of proposed opening, by whom final restoration shall be made, the estimated cost of restoration, estimated cost of inspection, amount of deposit, date of start of work, start of backfill, start of temporary restoration, and final completion of the work. The reverse side of the form should be ruled with horizontal lines, so spaced that the street restoration inspector may make suitable sketches of the location of the opening and necessary notes as to the date and kind of restoration, if completed by city forces.

It appears advisable that these Street Opening Permits be issued in quintuplicate for the following distribution; one copy to each of the following: the permittee, the public works records office,

the street restoration inspector, the street restoration foreman (if work is to be performed by city), and the city auditor. The City of Cincinnati issues also a copy to its water works department which uses it for a unique purpose, namely, to determine the amount to be charged the contractor for his use of water in making the street opening.

Two Classes of Permits

In the issuance of permits, it seems expedient that they be classified into two groups according to the nature of the proposed work. In the first group would be placed all work of a minor nature, such as repairs to various structures, minor renewals of services, sewer taps, etc. Permits of this kind should be issued as a matter of routine immediately upon the permittee's supplying the information requested on the form, and placing a suitable deposit to guarantee street restoration, which will be discussed later.

In the second category are placed those applications for construction of or alterations to capital structures, such as mains, conduits, manholes, etc. In this latter case, in addition to supplying the information requested on the permit form, it is highly desirable that the permittee accompany his permit application with a plan and cross-section of the proposed work, in triplicate, which shall indicate, as accurately as possible from the records available, the location of existing underground structures in relation to that of the proposed structure. Prior to the issuance of these permits for capital structures, it seems that the requirement of a careful scrutiny by the city engineer, the superintendent of street maintenance, and the superintendent of public works records to consider the possible effect of this proposed work on existing structures, traffic, and future maintenance, will eliminate the possibility of unsatisfactory conditions resulting from these installations. Of the three copies of the installation plans submitted, one copy should be returned to the permittee, the second given the street restoration inspector, while the third can be routed to the platting section for revision of the underground structures records.

In connection with the issuance of capital structure permits, we should like to bring out one pertinent point at this time, namely, the matter of the responsibility for the location of these capital structures. It is our belief that the company making the installation of the capital structure should at all times be responsible for its

location, and should be specifically informed that the issuance of a permit for the installation of a structure gives no guarantee of a permanent tenure of that position. The adoption of this point would greatly facilitate the moving of mains where necessary in connection with street improvements.

An accurate map, corrected to date, and indicating the nature of the pavement on all streets in the city, greatly assists the issuance of permits.

Office control of street openings is materially aided by properly indexing the permit forms both alphabetically and chronologically, a practice which results not only in quick access to a questioned permit, but also, in the case of the chronological file, permits an excellent follow-up of tardy restoration work. One desirable item of control attendant on the issuance of permits is the designation of the pavement type to be restored. This permits the choice of the proper surface in the case of old pavements which have been resurfaced, and boulder, waterbound macadam pavements, etc. The entire Cincinnati policy of street opening administration is based on the assumption that the pavement to be opened is in proper condition prior to the issuance of the permit and is to be restored to a state equal to or better than its original condition.

Securing Guarantees of Payment

Second in importance only to the requirement that permits be secured, should be the method of exacting a guarantee of payment of the cost of the restoration of the street opening. Our experience in Cincinnati indicates that the most satisfactory guarantee is the requirement of a cash deposit by the applicant equal to the estimated charge for the restoration at scheduled prices, prior to the issuance of the Street Opening Permit. Price schedules of pavement restoration should be developed from cost records accumulated by the public works records division and modified from time to time to conform to actual experience. A sliding scale of prices dependent upon the area of opening appears to be desirable. For the purpose of simplicity in the case of utilities, and other companies whose work requires the making of a number of street openings each year, the maintenance of a running account with the city by making a suitable initial deposit, which is replenished from time to time as required, is a great convenience. One exception to this deposit requirement can safely be made in the case of contractors on city

public works projects, who may be issued a permit without deposit on the condition that the restoration charge be paid before the contractor receives final payment.

A small, but nevertheless highly important phase of the administration of street openings concerns the matter of openings in newly improved or resurfaced streets, which undoubtedly are productive of the most bitter forms of criticism. In general, these requests for openings in newly improved streets result either from failure to inspect and repair structures properly in advance of the improvement, or from the totally unexpected failure of an apparently serviceable structure. The first cause can be overcome by soliciting the cooperation of all of the affected utilities, by making certain that notices of pending new construction and resurfacing are sent to the companies concerned sufficiently in advance of the work, and by the establishment of severe penalty charges for openings made in newly constructed streets. In the case of Cincinnati, this penalty charge is computed at 2 per cent of the entire street restoration bill for each unelapsed month of the three-year restricted period. Thus it is conceivable that a cut occurring within a period of 30 days following a new improvement may result in a penalty charge equaling 72 per cent of the total restoration bill. By the adoption of this rigid penalty clause, and by more effectively seeking cooperation of the various utilities, Cincinnati was able to reduce the area of cuts in restricted streets from 362 square yards in 1931 to only 13 square yards in 1937.

After a very careful study of the highly debatable subject of street restoration, I have concluded that the promptness and quality of workmanship in street restoration work can be effectively controlled only if the municipality performs all restoration work with its own street repair forces. In this case of course, the municipality must realize the necessity of prompt, workmanlike pavement replacement.

Aside from the previously mentioned advantages of the controlled quality of workmanship and the promptness, there are other desirable considerations in connection with restoration, such as clean-up following the job, miscellaneous street repairs in connection with the restoration, and completion of the work to the satisfaction of the affected property owners. However, in the event that it is not feasible to perform restoration in this way, an effective means of securing satisfactory restoration by the street opening

contractor is the requirement that he be responsible for the condition of the street pavement for an indefinite period of time. This requirement, together with careful inspection on the part of the city, should result in reasonably satisfactory pavement replacement. Again, most contractors are repeaters; that is, they will again request permission for street openings at a later date, which fact tends to increase control of their work.

Necessity for Field Inspection

In spite of the most carefully planned regulation of the issuance of Street Opening Permits, satisfactory administration cannot be assured without adequate field control. This is secured by adequate specifications and a staff of street restoration inspectors provided with automobiles, each of whom is assigned to a district, the size of which is determined by the average number of street openings made in that area. These street restoration inspectors should work under a supervisor with the ability and the authority to interpret questioned portions of the specifications and regulations. The specifications and regulations should set forth clearly and concisely the manner in which all street restoration procedure is performed, beginning with the preliminary application for a permit through the final restoration of the work.

To attain the necessary degree of control, a street restoration inspector should be assigned the following duties:

1. To make certain that the contractor has the proper permit.

2. To verify the location, number, and size of opening and to confirm the fact that the type of work is in accordance with the statement on the Street Opening Permit. Verification of the permit location requires a sketch indicating the exact location of the pavement openings so that their location at a future date can be readily determined.

3. To make certain that the contractor does not create any dangerous traffic situation, nor impede the normal flow of traffic. In connection with the maintenance of the proper traffic conditions, the observance of this rule, especially in the urban area, frequently dictates night work, or work during other than normal working hours. In the case of capital structures, the working hours shall conform to those set forth by the city engineer when he approved the permit application. The performance of work at night, of course, makes the requirement of safety even more important, as

no street work should be in any degree confusing to the motorist.

4. To insure at all times that the pavement is not endangered by inadequate sheathing or shoring, which may result in undermining, and in future street failures; and that no other street functions such as drainage, access to property, cleanliness, are impaired.

5. In the case of sewer tapping, to witness all taps to insure the proper workmanship to prevent future cave-ins and to locate the tap for future maintenance reference.

6. The careful inspection of all backfilling operations to insure their strict conformance to the city specifications. These specifications, incidentally, should be very specific as to the kind of backfill material and its degree of compaction, particularly of the backfill material directly around the structure itself. There is no question but what the matter of backfilling is probably the greatest single problem attendant on the field control of street openings. While the placing of materials in thin layers and the careful tamping by mechanical tampers would seem desirable, this regulation could not be enforced in the case of the multitude of plumbers who make street openings by hand entirely for sewer taps, and in other small work. Furthermore, it would definitely slow up large construction work. It would seem desirable, therefore, to limit the requirements of mechanical tamping to cuts of certain size in the higher types of pavement which ordinarily require compressors to penetrate the paving surface. In the case of the larger trenches, proper compaction of the backfill material around the structure itself should at all times be enforced. Also, the backfill material itself should be examined, and all unstable material should be replaced with some material similar to pit-run gravel. While it is preferable, of course, that this backfill be placed in thin layers thoroughly tamped, for the sake of speed it seems advisable to allow the backfilling of the trench up to a point 24 inches below the paving. The material should be thoroughly flushed, until it evinces no further tendency to settle. The final 24 inches should be placed in 6-inch layers thoroughly tamped, in order to provide a firm surface over the relatively soft backfill.

7. To require that the permittee provide a satisfactory temporary restoration until the backfill reaches the desired degree of compaction. The most suitable material for use in the temporary restoration is a flexible bituminous mixture which may be maintained from time to time if settlement takes place. Very careful inspection

should be made of the temporary restoration of all newly placed backfills, especially during periods of precipitation, and all settlements should be referred to the contractor for his immediate attention. In the case of the failure of the contractor to provide prompt repairs to the settled areas, the condition should be referred to an emergency crew of the city forces for the necessary action, which of course, will be billed against the contractor. The matter of backfilling cannot be too highly stressed, as the best final restoration work will not atone for a poorly compacted trench.

8. When the pavement is replaced by city forces, we believe that the chief function of the street inspector should be merely to make certain that all necessary work is performed in a prompt manner, leaving the supervision of the workmanship itself to the supervisor in charge of the repair crews, to avoid any possible conflict in authority.

The cost of street restoration by city forces should be carefully recorded in the field daily by the foreman in charge of the work, and sent to the records office for tabulation and computation. This cost information should be the basis for the street restoration charges which should be modified from time to time to conform to the cost experience.

In the case of restoration by the permittee, the street inspectors' duties will of course include the inspection of the material and workmanship as well as making certain that interference to traffic is minimized. The greatest advantage which may be claimed for the permittee's performing his own work is the fact that the entire responsibility, not only for the backfill but for the condition of the restored pavement, is his; a responsibility which may be very difficult to fix when the city performs its own restoration.

Street restoration inspectors can also be utilized to perform other duties in their spare time, as the nature of their work makes them a very efficient force for the inspection of pavement conditions, investigation of complaints, etc.

At this point I should like to mention briefly a few miscellaneous policies which have been adopted by the City of Cincinnati with regard to the administration of street openings. In my opinion they have considerable merit.

It is required in the case of tunnels or borings made beneath the street pavement that these tunnels be backfilled with lean concrete upon completion of the work. This work of backfilling is always

supervised by a regularly assigned inspector, who remains on the job until the work is completed. The concrete is mixed with the minimum degree of water necessary, and rammed in place to minimize the contraction of the mass.

If a permittee causes excessive destruction of pavement material while making a street opening in the case of restoration by the City, he is penalized for the value of the materials destroyed. This practice was found necessary to curtail careless action, particularly on the part of pneumatic hammer operators.

The policy pursued with regard to restoration work is that the restoration at all times must be equal to or better than the original pavement. Accordingly, in the case of cuts in concrete sidewalks, the permittee is required to restore full blocks of sidewalk, no partial restoration being permitted except in the case of walks which are in very poor condition. Openings in boulder, waterbound macadam, and other low-class types of pavement, must be restored with a bituminous concrete surface on a stone base, which gradually betters the pavement type. Furthermore, cuts adjoining roadways having unimproved shoulders must be restored with material similar to that of the roadway, which policy often results in a very desirable widening of narrow pavements. Full protection must be afforded all underground structures by the permittee, and great care is taken to make sure that this requirement is observed.

In conclusion, it seems fitting to reiterate the opening statement: "No phase of public works administration requires and deserves more careful control than the matter of street openings."

DISCUSSION

Charles W. Williams

Assistant Commissioner of Borough Works, Borough of Manhattan, New York, N. Y.

I have read Mr. Brokaw's paper and found it an excellent description of a well thought out and executed program for the control and regulations of pavement cuts. In New York the maintenance of the pavement and the control of and restoration of the pavement cuts are carried on by the president of each borough, and in Manhattan our system follows pretty much that outlined by Mr. Brokaw, except for some minor differences.

I will speak of some points where special problems have arisen and where our treatment has been changed to meet them. In connection with the question of a deposit and payment for restoration, it is our practice to require a deposit of $80 in connection with plumber cuts. When the cut has been completed and restored the cost of the restoration is deducted from one-half of the deposit—that is, $40, and the balance of the $40 is promptly returned to the plumber. The other $40 is retained for six months to take care of any defects that may develop in the plumber's work and after that it is returned to him.

The method of charging for repairs is based on the area of the repair job. The unit cost is the average cost of restoration per square yard for the week during which the cut was made and the week during which the cut was restored. This simplified our cost keeping and gave us an accurate cost for the time of the year, etc., and yet made it unnecessary to keep separate costs on each small job.

Opening recently paved streets is one of our meanest problems. It is now our practice to notify in advance all utility companies, as well as all owners of property abutting on the streets to be repaved, and then when the pavement is laid it is our general rule to refuse any permits to open the street for a period of one year and, in some cases two years, after the pavement has been completed. We cannot exact any penalty if it is necessary to reopen the street, but we restrict permission to emergencies that we feel sure could not have been foreseen. Unfortunately a great number too many of them crop up.

I agree with Mr. Brokaw that the municipality should perform all restoration work itself. However, the franchises of the utility companies in this and in many other cities permit them to make their own repairs. In doing this, however, they use an established and experienced paving company, approved by the boroughs, which is held liable for all repairs for a period of a year or longer.

The borough uses its own forces for restoring plumber's cuts and any cuts other than those made by the utilities.

I have found Mr. Brokaw's description of the duties of street restoration inspection a very thorough one. Our patrol inspectors are called upon to cover a number of features other than pavement condition, and they cover the borough on foot. They have certain areas which they are supposed to cover in one week. In addition, we are instituting a special inspection service which we believe will

go a long way toward solving the problem of prompt repair of plumber's openings. Because of the tremendous amount of traffic in our streets, plumber's cuts that are not repaired at once are very objectionable. Temporary surface put in by the plumbers is almost never satisfactory, and if they are not very closely watched they won't put it in at all.

The plan is to have men with cars who will visit daily each location for which a permit has been issued until the cut has been made and backfilled, or until the time of the permit—ten days—has expired. As soon as the backfill is complete, the concrete gang is notified and the pavement base is placed. Immediately thereafter the surface is laid by a paving or asphalt gang. A well backfilled cut is, in our opinion, as much ready for pavement restoration in two days as it will be in two weeks. We have been experimenting with this system in a part of the city and have in this section effected a large reduction in time between the backfill and the restoration of the plumber's cut, so far without an appreciable increase in cave-ins. We hope ultimately to extend the system to the whole borough and reduce the time between completion of the backfill and the restoration of the pavement to three or four days.

Asphalt Street Repair Methods Compared

D. Benton Biser

Director, Commission on Governmental Efficiency and Economy, Baltimore, Md.

The survey of sheet asphalt street repairs which is summarized in this paper was undertaken at the request of the City of Baltimore. The agency making the survey was the Commission on Governmental Efficiency and Economy, which is an independent, impartial, fact-finding agency supported by private means and maintaining a full-time staff to conduct scientific research in the field of municipal and state governmental operation.

The object of the study was to examine methods and to survey results in Baltimore as compared to other cities similarly situated.

The study was designed to deal chiefly with operating policies and methods affecting the quality and the cost of maintenance.

Scope of the Survey

The operations on Baltimore's streets were followed throughout a year's maintenance program. The Commission's staff also closely studied in the field the methods and practices of eleven other cities. In order that observations of the work actually in progress might reflect more nearly everyday conditions, those cities were not informed in advance of the inspection.

The streets in various sections of each city were examined, and the asphalt plants and the crews at work in the streets were visited. Every detail of the manufacture and handling of the paving material received close scrutiny. Specifications and their application were studied and compared; administrative procedures and supervisory routines were examined.

Highway officials, engineers, inspectors, and foremen were interviewed in the office and on the street in those cities, and consultations were held with highway construction experts and advisory technicians of the asphalt industry. Data from other than those eleven cities were obtained by correspondence, including the circulation of questionnaires.

The cities visited were New York (Borough of Manhattan), Brooklyn, Jersey City, Newark, Trenton, Camden, Philadelphia, Wilmington, Washington, Richmond, and Cincinnati. The cities from which data were obtained by correspondence were Buffalo, Cleveland, Columbus, Detroit, Los Angeles, Milwaukee, Minneapolis, New Orleans, Norfolk, San Francisco, St. Louis, Wheeling, Boston, Louisville, Pittsburgh, Providence, Rochester, and Utica. Other sources of data were the State of Indiana and the State of Pennsylvania, the Asphalt Institute, Public Administration Clearing House, the International City Managers' Association, American Society of Civil Engineers, the American Municipal Association, and the American Public Works Association.

General Conclusion

Analysis of the data so obtained in and from the foregoing cities and other sources indicated that certain elements of policy, method, and workmanship for the most part were characteristic of the general condition of sheet asphalt streets and of the results obtained in

repair operations. The condition of the streets and cost of repairs apparently did not depend upon the presence or the absence of one or two factors alone.

Whether or not the asphalt plant was publicly or privately owned, whether or not the repair operations were by city forces or by contract, and whether or not the asphalt cement was the so-called natural or the oil-refined product, all appeared to have little bearing on the cost and quality of the sheet asphalt repairs and the general condition and appearance of the streets.

The survey seemed to indicate instead that many details of operating practice contribute to the results attained by the repair methods. That conclusion resulted largely from the fact that in cities with streets that were comparatively outstanding in quality and condition, it was observed generally that all of a number of relatively minor details of policy and workmanship were being practiced, while the reverse generally was true of cities exhibiting streets of apparently poorer quality.

It was found that the best results were being obtained where the plant and street equipment were up to date, complete, and well maintained; also where air driven cutting tools were being used; where gasoline driven rollers capable of very slow speeds and easy stopping and starting were used; also where the mixes at the plant could be and were well regulated and carefully separated, handled, and watched.

Inspection in the cities where the work was done by contract was on the whole especially rigid and the contractor was obliged to accommodate the disposition of his crews and equipment and the speed of his work to the inspectors' requirements for thoroughly examining each phase of the operation and each single repair made. Carefully written standard specifications in printed form were found in cities where the contract system was in successful operation and the condition of the streets noticeably good.

Details of Workmanship

In cities with the better street surfaces, the edges of the areas to be repaired were straightened to prevent irregular saw-toothed joints; old material was cut out and removed in such a way as not to disturb the sound pavement surrounding the area or to leave ragged joints. Areas to be repaired were thoroughly cleaned and the edges well coated with asphalt cement and the binder course broomed

before the topping was applied. The material placed in the repaired area was not permitted to overlap the joint with irregular and feather-edged flaps. Fresh material being spread was not walked upon; it was well shoveled and raked. A straight edge was used to obtain proper grade and level surfaces.

New material around all edges and in places inaccessible to adequate rolling was thoroughly compacted by tampers. Thorough compaction was obtained by adequate and careful rolling. The sudden changing and reversing of the direction of the roller while on the surface of the repair was not permitted. Lime dust and cement dust were seldom used to cover the repair before its final rolling and in any event not before the surface had been carefully inspected.

Cities having good street surfaces were found often to reject material received on the job from the plant. Topping delivered in excess of that necessary to complete the day's last patch was not cast over a new patch but returned to the plant or dump. Also it was noticeable that in cities with not-so-good street surfaces, material was seldom rejected.

Patches with the binder course in place were not subjected to traffic and such areas were seldom left over night without the topping course to complete the repair.

Observations indicated the soundness of the policy of concentrating repair work on principal streets; also the repairing of a damaged area by replacing a liberal portion of street surface. The results appeared generally unsuccessful where the repair was restricted to too small an area of street surface involved.

Most of the cities with noticeably good streets paid prompt attention to the cleaning and filling of cracks in sheet asphalt surfaces, particularly on secondary streets where extensive repairs could be deferred. The most successful practice in this connection gave careful attention to the tooling of the cracks and their thorough cleaning before their careful sealing with suitable material.

Aside from the obvious physical relationship, the evidence was not conclusive that the thickness of the concrete base could be used as an excuse for the condition of the sheet asphalt street surface.

Pavement Cuts

The survey indicated also that in cities with good streets a careful control was maintained over the disturbance of pavements by

utilities and others to reach subsurface structures. Observations indicated that the successful repair practice was to support the new concrete base upon firm concrete by cutting back at least six inches beyond the edges of the original cut or beyond the limits of any settlement or disturbance of the subgrade caused by the opening in the street. Similarly, old asphalt courses were cut back at the time of repair.

In most of the cities examined, the utilities, city bureaus, and others were charged with the total amount of the repairs involved by any structure owned by them or resulting directly or indirectly from any cut in the pavement or other work done by them. In most cases the responsibility for the condition of the pavement and repair of such cuts extended for one year and this was made a condition of the permit issued for opening the street paving.

Ownership of Plant

Of eighteen cities of approximately 500,000 or more population questioned on the subject, all but four owned and operated asphalt plants. Of the eleven cities visited, all but two owned and operated municipal plants. In five of these eleven cities the general conditions at the plants were noticeably better than at other plants. In each of those five cities the plants were municipally owned and operated. However, in two of the eleven cities visited, the general condition of the sheet asphalt street surface was comparably poor and in each of those cases the plants were municipally owned and operated. In five of the eleven cities the general condition of sheet asphalt streets was noticeably good. In all but one of those five cities, the plants were municipally owned and operated.

There was little evidence that municipally owned and operated plants were overmanned. Data as to the cost of the plant, its operation, and the cost of street repairs did not present evidence conclusively in favor of a municipally owned and operated plant, provided the contract system was adequately controlled and the work well supervised.

Considerable emphasis, however, was placed by every city on the advantage of having a municipally owned and operated asphalt plant in order that repairs might be made immediately without waiting for them to accumulate in sufficient quantity to justify a contract, such waiting tending to aggravate the damage and increase the amount of repair work necessary.

It was found not to be impractical for an entire city to be serviced for sheet asphalt repairs from a single well operated plant, whether owned and operated by a contractor or by the municipality.

Duration of Repair Program

In four of the eleven cities visited, repair work was being carried on for a greater portion of the year than in others, without apparent difficulties, although extra precautions were used in such cities during adverse weather conditions. Most of the cities indicated repair programs which lasted for eight or nine months of the year. Many cities were found to carry on repair operations at night in the congested areas and to divert traffic from blocks of the street under repair.

Comparative Costs

Available cost data were subject to so many questions, and cost comparisons to so many qualifications, that the survey did not develop a thoroughly sound average cost figure. The data, however, indicated that the condition of streets did not vary directly with the cost of repairs; also that sheet asphalt streets of outstanding quality and appearance were being maintained in several cities at an average cost of less than four cents per square yard of the total sheet asphalt area in service.

Repairs by Heater Method

It was found that some cities by using the heater method to resurface only, apparently were stretching their repair funds further and successfully deferring the cost of major repairs requiring complete replacement of both the topping and binder courses and in some cases also the base. In addition to the savings in cost, the heater method was found to be successful under both contract and municipal operation. The finished surface of repairs by the heater method was found to be especially good in appearance and the repaired areas were difficult to distinguish. The bonding of the new material to the old surface seemed to be facilitated by the heater method, and practically no evidence was found of the separation of the repair from the old surface such as was often found in the case of the repair by replacement of the entire binder and topping courses. Skilled workmanship, the type of equipment, and supervision, however, seemed to be important factors in the results ob-

Materials

The study did not deal with characteristics of material, their proportioning, or the manufacturing processes best suited to local needs. Nevertheless, it became apparent during the survey that everywhere local factors are encountered which affect the problem of producing the paving best adapted to the use of the various localities. One such factor of importance was the source of suitable sand and stone available without heavy transportation charges.

As to the kind of asphalt itself used in the manufacture of the pavement, no consensus was indicated on the part of engineers in other cities. Most of the cities visited used oil-refined asphalt, but four cities used the so-called natural asphalts, some exclusively. Most of the engineers indicated their preference for the type of asphalt they were using, but the general condition of the streets and their appearance did not present conclusive evidence in favor of either the oil-refined or the natural asphalt, there being too many other factors affecting the quality of the finished pavement, from the source of the materials themselves to the final laying of the manufactured paving material.

Successful results were being obtained by cities in the use of concrete that is mixed in transit to the site of the repair. Cities using that method reported that control of materials, their proportioning, and the quality of the concrete and inspection were facilitated by that method.

The foregoing summarizes some principal features of most of the data collected by the survey. Some of the findings may be controversial or at least they may be contrary to the individual experience of some highway engineers. Nevertheless, the observations and the interpretations presented are those of an impartial staff which conducted the fact-finding survey herein reported.

DISCUSSION

George W. Andress

Engineer in Charge, Bureau of Streets, Newark, N. J.

I am not surprised at the very interesting paper of Mr. Biser's as I spent considerable time with one of his investigators when he visited the City of Newark.

every phase of the subject from the minor details of workmanship to the larger questions of policy.

The methods employed in making asphalt repairs are more or less the same in all cities and surely the standard of good practice is recognized by engineers generally. However, the extent to which certain well recognized practices are employed depends largely upon local conditions. Unfortunately our own City of Newark has not of late provided, because of financial conditions, the funds we know are required to make adequate and substantial repairs, with the result that a resort to less adequate and less expensive methods is often necessary to make the streets safe for traffic. This, I suppose, is the state of affairs in many other cities.

At the time Mr. Biser's investigator was in Newark I gained the impression that the City of Baltimore was much interested in the comparative cost of asphalt pavement repairs by contract and by municipally owned plants, and in the advantages of municipal operation.

I have been much interested in this subject myself and have tried to clear my mind of any bias one way or the other in evaluating the facts presented by the experience of the City of Newark. It is this phase of Mr. Biser's report that I have decided to discuss by giving the facts as we have found them.

Our municipally owned asphalt repair plant consists of the usual complement of mixing machinery, sources of power, heating kettles, conveyors, and storage bins, all housed in a brick and steel building with railroad siding and a dock on the river to receive materials.

The original cost to the city for the development was as follows:

Building	$49,000
Mixing equipment, conveyors, pumps, etc.	32,700
Dock	38,000
Dredging	76,000
Land	10,000
Railroad siding	3,000
	$208,700

There is no bonded indebtedness outstanding today against the city for this improvement.

The maximum capacity of the plant in one day of eight hours is 130 tons of wearing surface mixture. The total production of the plant during the year 1937 in the following materials was as follows:

Sheet asphalt wearing surface mixture ...	4,018 tons
Asphalt binder	2,212 tons
Bituminous concrete	1,340 tons

The estimated cost of this production per ton for the three items above mentioned was:

Sheet asphalt wearing surface	$6.64
Asphalt binder	5.24
Bituminous concrete	5.83

These figures include the cost of the materials, the labor operating the plant and mixing, maintenance and repair of plant building and appurtenances, depreciation, supervision, and the proportion of idle time directly chargeable to the above.

The average contract cost per ton of these materials in Newark during 1937, manufactured by private plants loaded on the buyers' trucks, was as follows:

Sheet asphalt wearing surface	$5.90
Asphalt binder	4.20
Bituminous concrete	5.65

The total production in 1937 of our plant in sheet, binder, and bituminous concrete was 7,570 tons.

The plant, during 1937, was used for drying sand and stone for other paving operations and for drying sand for spreading on slippery pavements during the winter. This amounted to over 2,000 tons of material handled through the plant. The cost of this work is not included in the before-mentioned figures.

The plant remained in operation during the entire year when weather conditions were favorable except for a period of about three weeks in the spring when undergoing seasonal repairs. The daily production ranged from a few tons a day to about 100 tons a day, as the need for the material developed.

The advantages to a municipality in the complete control of its repairs through a municipally owned plant I believe are well recognized. Our experience in this regard has been varied. When business was good with the contractors they did not want to be bothered with our small production and at the present time they will not open their plants just for our work at any reasonable price.

We are permitted the opportunity of all-year work instead of being required to allow sufficient repair work to accumulate to make contract work profitable. Prompt repairs make our yardage of repairs

much less by preventing the enlargement of repair areas caused by traffic and weather conditions. Also, we may shift gangs at will as the need arises. As a result of these advantages, we believe we have more control of the work at less cost than would be the case with contract repairs.

Although contract prices for bituminous materials in 1937 were about 10 per cent under our cost of manufacture, it should not be forgotten that while our costs are fairly uniform from year to year, for the same production, contract costs vary greatly. For instance, contract costs for materials in Newark today are barely more than 50 per cent of what they were ten years ago. Our costs for 1938 will be made lower by about 25 per cent than they were in 1937, because of greater production in 1938.

It is my opinion that it may be advisable in cities requiring a large area of asphalt pavement repairs to supplement, at times, municipal plant operation with repairs by contract, the entire street operation to be with city forces, but I am convinced that cities having sufficient work to justify a municipally owned plant can give better and more economical service to its citizens by first establishing a city-owned plant.

Walter E. Rosengarten

Engineer, Lower Merion Township, Ardmore, Pa.

The survey of asphalt street repairs as made by D. Benton Biser is most interesting and from it have been drawn conclusions which are sound. If they could be generally adopted, better street conditions than exist in most communities would result.

Unfortunately, the survey covers only the larger cities. The vast majority of our municipalities are, however, under fifty thousand population. Of these, Lower Merion Township with forty thousand population would be typical. It is a suburban community adjacent to one of the largest cities, Philadelphia. Traffic is rather heavy. The Lincoln Highway to the west, as well as several other routes through the community, averages seven to ten thousand vehicles per day. Therefore our experiences with asphalt street repair may be of interest.

The township maintains five gangs consisting of a foreman and five to ten men, each with truck and miscellaneous tools. Their

duty is to repair and ditch some 140 miles of roads of which 93 per cent are paved. Of the paved surfaces, 97 per cent are asphalt. The work of the maintenance gangs includes patching street openings, filling holes, shaping dirt roads, ditching uncurbed streets, repairing drainage structures, guard rails, and street name signs, as well as constructing numerous minor improvements.

The patching of street openings is usually given to one gang which because of experience makes an unusually neat patch. This practice has reduced the cost of the work. A permit is required for all work done by other than highway forces within the right-of-way of our highways. The charge for most of the items is $1. Where paving is disturbed, it is repaired by township forces at $9 per square yard. The one opening a street is required to tamp the backfill thoroughly and replace the old paving for temporary service. He is then required to maintain the surface in good condition for a period of several weeks to allow for settlement. The township patch gang then cuts back the edges of the patch, and places concrete base and surfaces with a material to match the surrounding paving. Most of our paving in recent years is a cold lay, coarse mix, asphaltic concrete laid in two courses. In patching a penetration macadam surface, a coarse asphaltic concrete is used which is covered with stone chips in order to match the surrounding paving.

The community is fortunate in having a number of asphalt mix plants within ten miles. Each year a contract is let for asphaltic concrete material both delivered on our trucks at the plant, and delivered on the road. This year it is priced at $4.50 and $5.00 per ton respectively. It is not felt that we have sufficient work to justify the maintenance of a municipal plant. During winter months when the contractor's plant is shut down, we experience some difficulty. Emergency patching, however, is cared for either from a storage pile made up prior to the closing of the plant or with cold patch prepared by the maintenance gang with cut back asphalt.

The use of special patching equipment is of considerable assistance in obtaining a satisfactory job. In recent years we have used extensively a half bag portable mixer, also a compressor both for cutting the edge of the paving and tamping the patch. This has resulted in better work at a reduced cost. The average cost for patching asphalt streets in recent years has been $21,890 per year or 1.5 cents per square yard per year. We heartily agree with the conclusion of Mr. Biser that it is difficult to charge unsatisfactory work

to any individual item. Good results can be obtained only by careful attention to all details of both workmanship and materials.

Street Repair and Maintenance Problems

A Panel Discussion

CHAIRMAN SHAFER: The subject for this panel discussion is "Street Repair and Maintenance Problems." It is probably one of very vital interest to every city official and especially to the man directly in charge of the work. As you all know, city streets have been grossly neglected during the depression years because of our very limited funds. As a result, the engineers are faced today with a big program of street repairs and deferred maintenance operation.

The members of the panel are: GUY C. DE WITT, Assistant City Engineer, Utica, New York; FRANK J. HARTMANN, Director of Public Works, Camden, New Jersey; LEON F. PECK, Superintendent of Streets, Metropolitan District, Hartford, Connecticut; THOMAS E. COLLINS, City Engineer, Elizabeth, New Jersey.

Under the heading of "organization," what services should be grouped with street maintenance in the general organization plan? I might state what our practice is in Pittsburgh. The Bureau of Highways and Sewers is the maintenance department. We have charge of all repairs, cleaning of streets, sewers, all of the walks the city has built from time to time, and a lot of walks we have built on unimproved streets. We have a total of 1,350 miles of streets, of which 850 miles are paved with various types of pavement. The 500 miles of streets on the hillsides, as a rule in rather undeveloped territories, constitute a tremendous drainage problem. At one of the recent meetings of the Society I asked Sam Eckles, who was then Chief Engineer of the state, what he does about 20 per cent grades. He scratched his head for a moment and then said, "We don't do anything with them because we don't have them." Well, we have to take care of grades up to 25 per cent, and there is a lot of traffic over those grades.

I would like to get any special information as to the types of pavement that will stand the beating those streets take. They consti-

tute a tremendous maintenance problem because the drainage of these undeveloped streets down to our paved streets carries a lot of debris and silt into our main sewers, and it is a constant menace to traffic all the time.

Mr. Peck: In answering your question I would say that construction should be linked with maintenance.

Chairman Shafer: I am glad to hear you say that. I agree, although we are not set up on that basis. At the present time the Engineering Department handles all new paving and repaving.

The Efficiency and Economy Commission which was established four years ago to study our problem was very emphatic in recommending the combining of the construction of pavement with its maintenance so that the information as to the life and cost of repairs could be properly set up to aid in determining when a street should be resurfaced or repaved. That is a question of obsolescence. What is your idea of that?

Mr. Hartmann: We have a fortunate condition in Camden. All of the different bureaus such as Plumbing, Water, Highway, Asphalt Plants—and we make our own asphalt—come under the Department of Public Works. With little or no red tape it is possible either to repair a street or construct a new one, and that is done under the Director of the Department who has the whole say.

Chairman Shafer: You are fortunate to have such close cooperation. Unfortunately that has not worked out so well with us but we are now trying to coordinate our work. I have resurfaced a street and then within one month's time the Water Department or the Street Department has gone in there and made some improvement. That is lack of coordination, but I guess you have all had the same experience.

Have you any suggestion as to a plan of organizing repair crews that is more satisfactory than another? What is your plan, Mr. De Witt?

Mr. De Witt: Our pavement repairs are let by contract. We have only a small gang that makes minor and temporary repairs.

Chairman Shafer: What do you do about your pavement cuts? Do you repair them with your own forces?

Mr. De Witt: That is all done by contract.

Chairman Shafer: Are those annual contracts?

Mr. De Witt: We ask for bids for repairs to pavements, that is, for cuts and replacements. The contract includes repairs over sewer

cuts, repairs over pipe cuts, etc. In other words, one contract takes care of all repairs made.

CHAIRMAN SHAFER: Do you set up a minimum quantity at the beginning of the year or is that left open?

MR. DE WITT: An amount of twenty to thirty thousand dollars is set up to take care of the straight repairs and if this sum does not cover it, additional amounts are authorized by the Council from time to time.

CHAIRMAN SHAFER: Have you experienced any trouble or argument with your contractor?

MR. DE WITT: No, it has been working out very satisfactorily.

CHAIRMAN SHAFER: Do your own inspectors see that the work is done properly?

MR. DE WITT: The inspection of pavement repairs is taken care of by the Department of Public Works and what their inspection is, I don't know. That is a separate department. We make the contract in our office for the Department of Public Works and then turn it over to them.

CHAIRMAN SHAFER: What is your practice, Mr. Collins?

MR. COLLINS: Elizabeth, New Jersey, is a city of 110,000 population, located close to New York and Philadelphia. We have 120 miles of paved streets, 75 of which are asphalt. In Elizabeth the state has ten miles of highway and the county has ten miles of highway. The state negotiates an asphalt contract each year and the contractor comes in and does the work, which is supervised and inspected by the state highway inspectors. The county has its own asphalt plant and does its own asphalt work. The City of Elizabeth lets its repairs by contract, with the exception of the small patches which are made with cold asphalt material.

CHAIRMAN SHAFER: Do you make your own repairs, Mr. Peck? That is, do you have your city divided into sections and have one supervisor in charge of all that work, whatever it may be, or do you have specialized crews for doing certain work?

MR. PECK: When I said I felt maintenance and construction should be under one head, I meant that there should be a top authority in one spot. In my experience I have not found it necessary that the repair forces and the construction forces be one and the same. They should be flexible, however, so they can switch from maintenance to construction and vice versa in the interest of economy.

Hartford practically always had to contract for the repair of sheet

asphalt paving, as it does not own any asphalt plant. Hartford has 120 miles of secondary pavement, the water-bound macadam, which is all taken care of by our district foremen with city forces.

CHAIRMAN SHAFER: The question of financing street maintenance from gasoline taxes, vehicle taxes, property taxes, or otherwise was covered in a paper this morning, or at least touched upon. I don't think we should go into that because it is a pretty broad subject, but I would like to say that in Pennsylvania the taxes go to the state; the County of Allegheny was receiving up to last year about a million dollars that was returned from the state. The City of Pittsburgh has been trying to get some of that money, but so far we have not been able to do it. We have almost as many miles of streets in Pittsburgh as in the whole county and we felt that we should have half the money. However, I understand from Mr. Buckley there has been some change and they might not get that much now, but the city should get a return from the gasoline taxes that go to the state.

We will go on now to the question of operating practices. Pavement cuts were discussed in a very good paper here this morning, so I don't think we need to dwell on that. I presume you all exact fees for permits to cover the cost of inspection. In Pittsburgh we have a scale of prices for different types of pavements. The Division of Utilities is supposed to inspect all plumber cuts. Unfortunately in the past the inspection has not been as thorough as it might be, because we find some imperfect workmanship. We had a case the other day where we had a combination sewer and when we got down twenty feet we found one of the utilities had cut off the lateral from the by-pass to the main storm sewer, which threw all the sanitation right into our main storm sewer and into Sawmill Run Creek. We could not pin it on anybody and we had to fix it up, but that illustrates one of the things that can happen when you have political inspection. However, I don't think that condition exists today. We still have politics but on the whole I think our inspection is pretty rigid.

What is your practice about plumber's cuts and sewer trenching and water trenching?

MR. COLLINS: When the Water Department or a plumber makes a cut in the street, we insist that the material be put back and a temporary cold patch be placed there until the permanent patch is put in. Then, just before the permanent patch is put in, we insist on

a six-inch cut on each side of the trench; then the concrete is put in and the asphalt on top of that.

Chairman Shafer: In other words you spread your new concrete base six inches over the trench. How is your temporary patch made on brick pavement?

Mr. Collins: Most of our brick pavement is on a concrete foundation and we insist that they put in a temporary filling and a cold patch until it takes its permanent settlement and then we put in our base and lay the brick. We insist too that reinforcing rods be placed under a brick pavement, six inches beyond the width of the trench.

Chairman Shafer: What provisions do you have for tamping, so that you can make your restoration as soon as possible? Do you require pneumatic tamping?

Mr. Collins: Most of the utilities in Elizabeth have pneumatic tamping by machines. Some of the plumbers have hand tamping and we have an inspector go out to see that it is thoroughly tamped.

Chairman Shafer: How long do you leave your temporary backfill and repair in before you put in the permanent restoration?

Mr. Collins: Two weeks.

Chairman Shafer: Do you require any guarantee from the plumber?

Mr. Collins: He has to pay a fee for making the cut. He puts up a deposit and after the pavement is restored anything left from the deposit is returned to him.

Chairman Shafer: What is your practice, Mr. De Witt?

Mr. De Witt: Our practice is about the same except we use reinforcing rods in all trenches. If they are shallow we don't insist on them, however, but we cut back a minimum of nine inches and in some cases the backfill is made with gravel where the existing subgrade is clay or something which cannot be compacted. A bond is required from all plumbers and public service companies so that the cost of the work is guaranteed.

Chairman Shafer: I think that practice is pretty general. We will go on to the subject of resurfacing. Do you use the cut-out method, heater method, or binder and top method?

Mr. Peck: We use both the old heater method and the binder and top method.

Chairman Shafer: Do you strip off any part of the asphalt pavement? I mean if you have an asphalt pavement that has been re-

surfaced and the crown built up from time to time, do you strip off any part of that before you resurface it?

Mr. Peck: It is not a case of cutting out then. The so-called thin patches are applied on the surface and feather-edged with very good results.

Chairman Shafer: After a pavement has been down for forty or fifty years and has been resurfaced and resurfaced it will eliminate your curb reveal. What do you do about that?

Mr. Peck: Well, eventually it is all removed and an entirely new surface is put on, and most of the real resurfacing is done that way. It is the smaller areas that are repaired by the other method. All of our asphalt is three inches in thickness.

Chairman Shafer: What is your practice, Mr. Hartmann?

Mr. Hartmann: In Camden the temperatures get pretty high in summer and we find heavy traffic does roll the asphalt into the gutter. When we are ready to do a resurfacing job we take that into consideration. We strip the asphalt from the gutter for six feet, put a binder down, and then we put a new layer of asphalt over the entire street. When it is completed I defy anybody to tell where the old and the new asphalt join.

At the end of fifteen or twenty years—which is about the life of synthetic asphalt—the asphalt will have been rolled into the gutter. No matter what city you go to you will find irregular gutters caused by the asphalt's being rolled there by heavy traffic.

Chairman Shafer: Do you find that over a period of years you increase your crown to a danger point?

Mr. Hartmann: We have not increased the crown and quite to the contrary. We come from a section different from yours. We have a very flat city and we have the same trouble now that we had years ago in trying to get sufficient grade even to drain into the gutters.

Chairman Shafer: I have been interested in this heater method. There is a heater working here around 155th Street. I was out to see it Monday and they were doing a very successful job. They told me they could strip off one inch with one application of heat and at one place they took as much as three inches off by three different applications. They follow the same plan Mr. Hartmann mentioned. They cut six or twelve inches from the curbing to the base and use the material that has been softened up and raked off by the heater as a filler next to the curb. Then they put their binder on and the

top right on that and roll it out, making a very satisfactory job. They salvage some of the material that has been heated and it seems to have life left in it. Evidently it is more of a softening process than a burning process. There is a certain amount of it burned, but that does not seem to make very much difference and it seems to work out very well.

I understand that New York has done 100 or 150 square yards on that basis this year and I would like to have somebody from the floor tell us something about that if they have had any experience with it. Pittsburgh tried it a good many years ago but I don't think the heater method was satisfactory at that time and they gave it up. However, we have a very serious problem in Pittsburgh because with this resurfacing we have a curb reveal of not over two or three inches, and with the heavy run-off we get on our grades it is a serious matter. I would like to get any information I can on that subject.

What type of material are you using on all of your resurfacing? That is, your asphalt resurfacing.

MR. COLLINS: We have a peculiar condition in Elizabeth. Most of our asphalt streets are new, but for our resurfacing we have to deal with a number of stone block pavements. One in particular that we are resurfacing now had a double car track. When we first started resurfacing stone block pavements we used an open binder one inch thick and a top of one and a half or two inches, but we found that the surface after a year or so was not very even. Now we are going to use a greater close binder and if possible we will let the traffic run over it for as long as a week before we bring the street up to a uniform crown and put the top on it. In other words, our theory is that the top is only as good as the binder.

CHAIRMAN SHAFER: Are you talking now about stone block resurfacing?

MR. COLLINS: Yes.

CHAIRMAN SHAFER: If your block is pretty good do you do much resurfacing, or do you find that it pays to relay or repair the block stone?

MR. COLLINS: If the street is very bad we try to bring it up so that it will have a uniform crown or contour. But, our theory is that if you have any stone block pavement that has been hammered down for ten or fifteen years, it is a mistake to try to take it up and

service it. I think it is better to build it up with a close binder than to bring your stone up and put the binder on top of that.

CHAIRMAN SHAFER: Are those pavements on a flexible base as a rule?

MR. COLLINS: They are mostly on sand foundations.

CHAIRMAN SHAFER: I agree with you on that. Of course block stone with us is very expensive. It costs about $120 a thousand, and we have very little money to spend. We have to use a lot of block stone on our heavy grades for unimproved streets, especially in connection with our W.P.A. program. To get that, we have adopted the practice of taking fairly good block stones from secondary streets and putting down a flexible macadam base, water-bound for the first course and penetration for the second course and then a granulated slag content with about a one to six mix of cement, with the top on that. It makes a very good job.

What do you do with your brick streets?

MR. DE WITT: We have some brick streets, but we have not had any occasion to do anything with them.

CHAIRMAN SHAFER: There is no salvage in bricks to speak of and we go right over the top of them.

MR. DE WITT: We have relaid some of our stone blocks, under the W.P.A. program, quite successfully.

CHAIRMAN SHAFER: Do you reclip the blocks or take them as they are?

MR. DE WITT: We relay them as they are and some of them we have resurfaced with asphalt or concrete.

CHAIRMAN SHAFER: Do you have enough asphalt resurfacing to justify a mechanical spreader?

MR. HARTMANN: We have our own asphalt plant which is situated practically in the middle of the city and so far as the extensive resurfacing is concerned, like all other municipalities, we do it only when we have to do it and not when we would like to do it. I would like to take exception to what the Chairman did in skipping over the most important subject of the entire panel discussion and that is, where are you going to get the money? I would say we should let the people who pay gasoline taxes and who wear out city streets have some of that money come back to repair city streets. Any street made of synthetic asphalt at the end of fifteen or twenty years is going to be deteriorated to such a point that it will

need immediate and constant care, especially if you have any amount of temperature variation.

Now, so far as Camden's needing a machine is concerned, we probably could use one. The way we work, we can at the present time distribute and spread as much asphalt as our plant will produce. Under W.P.A. we can get out 232 tons a day and we can spread that much, properly prepared and relaid, in an 8-hour day.

CHAIRMAN SHAFER: Are you using any cold mixes for your surfaces?

MR. HARTMANN: No.

CHAIRMAN SHAFER: Do you use just the hot asphalt binder on top?

MR. HARTMANN: Cold mix is too expensive.

CHAIRMAN SHAFER: Have you had any experience with cold mixes, Mr. Peck?

MR. PECK: We use no cold mix except for temporary patches and we use it in water-bound macadam because it is similar to the bituminous patch.

CHAIRMAN SHAFER: On our dirt street program we are using a six to seven inch water-bound base which we prime well and put down two or two and one-half inches of cold mix—what we call a B.Y.-1. We use an asphalt emulsion or inverted asphalt and put an inch or an inch and one-half top of fine material that will run to about 5/8 inch in size. We find that the use of slag on that makes a very nonskid surface, which is one of our big problems on these steep streets. We have this cold mix on grades up to 20 per cent and you would be surprised how non-skid it is.

If we build those grades with a limestone or any stone that will polish, it is almost impossible to keep the cars on the street, but with the cold mix of slag we have had remarkably good experience. We are constantly in argument with our chief engineer, but the state is having the same experience that we are having. They put down a lot of roads containing limestone and they are having a number of traffic accidents. I suggested that they put down a similar mix with an air-cooled slag and it solved their problem. Our chief engineer said he would not allow us to put asphalt on any grade over 10 per cent, as it must be block stone, but where are you going to get the block stone? We had to do something and that is what we are doing.

What do you do with your concrete streets when they begin to deteriorate?

Mr. Collins: We have practically no concrete streets in our city.

Mr. Peck: We did have several streets of concrete and we have tried to resurface them with sheet asphalt before they get too bad, and consequently there is very little repairing to be done. However, we have cut out small defective sections.

Chairman Shafer: Do you conduct a pretty thorough program of crack sealing?

Mr. Peck: Yes, that is our practice.

Chairman Shafer: What is the best time of year to do that work?

Mr. Peck: In the fall, but it should be done whenever it is necessary.

Chairman Shafer: But you think the fall is the best time?

Mr. Peck: Yes, not only with the cement concrete but also with sheet asphalt.

Chairman Shafer: Have you had any experience with the mud jack in raising sunken pavements?

Mr. Peck: No, we have had no experience with that.

Chairman Shafer: Have you had any experience with that, Mr. Hartmann?

Mr. Hartmann: We have not, but I have seen the State Highway Department lift a slab six inches at a time with mud jacks, in a portion of South Jersey that is very sandy. However, we have no reason to experience any such settlement. Should there be a small settling, we eliminate it by putting on a feather edge.

Chairman Shafer: On the whole you think mud jacks are practical to use?

Mr. Hartmann: Yes.

Chairman Shafer: Do you do anything on sidewalk repairs?

Mr. Hartmann: The owner takes care of the sidewalks. The only part of the highway maintained by the city is between the curb lines.

Chairman Shafer: Is it practical to use broken concrete from an old pavement as aggregate for concrete patch, either in mixed concrete or when grout is poured over the aggregate? Have you had any experience of breaking up an old pavement and using the material as aggregate?

Mr. Collins: I don't think that would be very good practice.

Mr. Peck: I am prejudiced against it.

Chairman Shafer: Have you ever laid any low cost concrete pavement by putting the aggregate down and pouring cement-bound macadam over it?

Mr. Collins: We have never done that.

Chairman Shafer: I don't think the practice is very widespread, but if anybody has had any experience on that I would like to hear from him.

On the question of snow removal, I saw a very good article in a publication of the Bureau of Public Roads, which with your permission I would like to read to you.

> Although the primary purpose of snow removal is to enable traffic to move with facility and safety, prompt snow removal also helps to preserve the road surface and shoulders. Snow should be pushed back from the shoulders to facilitate the flow of water from melting snow into drainage channels. Failure to remove snow from shoulders and allowing a thin coat of ice to remain on the surface results in erosion on low and intermediate type surfaces and loss of supporting value.
>
> The water from thawing snow or ice frequently runs along the edge of the pavement, softening the shoulders and allowing seepage under the pavement and into the subgrade. The excess water often cannot drain away through the ground because of an impervious layer of frozen soil below. The weakened road may fail under traffic, especially at the edges of flexible type surfaces.

I think the average city does not look at snow removal from that standpoint very much, but it is worth consideration and we will touch on that subject for a few moments.

What is your method of snow removal in your business section? Do you attempt to remove all of the snow from the business section, or do you just clear lanes of traffic and do the best you can with it?

Mr. Collins: In Elizabeth we attempt to take it all away because we have a very congested area in the heart of our city. We plow it and then load it into trucks and dump it in the river. In the outlying districts we simply plow the snow to the side of the road. Of course, we have patrol men going along to keep the catch basins open.

Chairman Shafer: In other words you open up behind the pile in order to get the run-off, is that right?

Mr. Collins: Yes, that is necessary.

Chairman Shafer: Do you use the plows on your heavier trucks?

Mr. Collins: Yes, reversible plows.

Chairman Shafer: How many snow loaders do you have?

Mr. Collins: We have three now and we use them in the business district.

Mr. Peck: I would like to say that opening the gutters is a very difficult job on narrow streets as they are the only place you can put the snow.

Mr. Collins: In our city we don't have many narrow streets. Most of them are thirty-six foot roadways.

Mr. Hartmann: Another thing—the gentleman from Elizabeth does not have very much snow. We did not have enough snow last year to need a snow plow.

Mr. De Witt: We remove the snow from the business section and then after that area is cleared we progress to the outlying districts with the loaders. We also have a patrol which opens the catch basins.

Chairman Shafer: Do the railway and trolley lines clear their own tracks?

Mr. De Witt: Yes, they run a broom over them.

Chairman Shafer: Do you follow that up and carry the snow to the curb?

Mr. De Witt: That is the idea.

Chairman Shafer: Do you make any charge to the railway company for handling the snow they brush off the tracks?

Mr. De Witt: No, we do not.

Chairman Shafer: They are trying to charge for it in Pittsburgh. They have never collected before, but they are trying to set up an item that runs into money. Is there any city in the United States which does collect from the railway for cleaning snow?

Mr. Peck: The utilities in Hartford, by agreement with the city, take care of the plowing for the full width of some of the streets on which they have cars, and then the city takes care of the plowing for the full width of other streets.

Chairman Shafer: Do they have plows other than the broom plows?

Mr. Peck: We have gotten them to dispense with car plows and use motor plows because they do a much better job and there is less danger of ice ruts along the car tracks. That idea has been developed in the last two winters, and I think they have found it to be in their interest. There is less tie-up now because vehicles are able to get

out of the tracks, which is difficult if ice is permitted to form ruts on the tracks.

CHAIRMAN SHAFER: That is a thought. You balance it by taking care of the less congested area while they take care of the congested area.

MR. PECK: We take one street and they take another and our routes are agreed upon. They also remove some snow. Hartford removes the snow from one-tenth of its entire mileage.

CHAIRMAN SHAFER: Do you use your storm sewers for dumping the snow?

MR. PECK: No, we do not. We dump it into the river. There is one section of our road that runs along the river for about a thousand feet and it makes an ideal place for disposing of the snow.

CHAIRMAN SHAFER: Do you have anything to offer on this subject, Mr. Hartmann?

MR. HARTMANN: There are two things we do not have and they are trolley cars and horse-drawn fire engines. All of our streets that had trolley cars have been resurfaced with sheet asphalt. The utility companies will not take care of any plowing and when we have a snow storm, we have to remove the snow with snow plows by pushing it into the gutters.

CHAIRMAN SHAFER: How about cinders? Do you have icy streets, Mr. De Witt? You don't have the grades to contend with that we do but I believe that Utica is in a hilly area.

MR. DE WITT: We do not have any grades over 10 per cent and all of those are cindered.

CHAIRMAN SHAFER: Do you use any chemical mixed in with the cinders?

MR. DE WITT: Yes, calcium chloride.

CHAIRMAN SHAFER: Have you noticed any deterioration of your concrete from the use of calcium chloride?

MR. DE WITT: Yes, we have noticed some.

CHAIRMAN SHAFER: Do you use any raw calcium chloride on any of your pavements?

MR. DE WITT: No.

CHAIRMAN SHAFER: What is its effect on asphalt pavement?

MR. DE WITT: We have not noticed any effect as yet.

CHAIRMAN SHAFER: Do you stock your cinders before the weather conditions get bad and do you use any calcium chloride or salt in your cinder piles to keep them from freezing?

Mr. De Witt: We have certain reserve piles, and we mix salt or calcium chloride with the cinders. That is for local use and it is always available.

Chairman Shafer: Is it proper to use available funds for maintaining unimproved streets when they are so vitally needed for repairing permanent pavements? Do you have any unimproved streets, Mr. Collins?

Mr. Collins: My answer to that is that a man who lives on an unimproved street is just as much entitled to a decent street as the man who lives on an improved street. Therefore, you should give him a little of the funds set up for that purpose.

Chairman Shafer: Where you have dirt streets such as we have, it is impossible to keep them in condition with just ordinary maintenance. We use a grader and shape them up every year, but after a few heavy storms they are in bad shape again. As a result, we are rebuilding those with W.P.A. labor, and have set up the practice of doing it without expense to the property owner. Of course, we are now loaded down with requests to do the whole 500 miles, and that is a big problem.

Mr. Collins: We have the same problem. We have an appropriation for the W.P.A. work and everyone who lives on a dirt street now wants it improved by the W.P.A.

Chairman Shafer: We are trying to work out a plan—and it may appeal to some of you—that they have worked out in Birmingham, Alabama. The property owners on the dirt streets pay for the materials and W.P.A. labor is used for doing the work. We have been paying for the material and the W.P.A. has been doing the work, but it is running into millions of dollars.

Up to last year the statutes were such that if we did make any assessment or allowed the property owners along the street to make any contribution, it was construed by the courts as being an assessment, and under the law an assessment once made would preclude the city or any municipality from ever making another assessment. We had that law changed last year after three years of effort and now we can assess for a semi-permanent improvement and if later we want to put in a permanent improvement, we can reassess and allow the original assessment as a credit against the ultimate assessment. With that law now we can work out such a plan as they have used very successfully in Birmingham.

Mr. Hartmann: Every state in the Union can do what New

Jersey is doing. They are improving all of the county roads with a combination of state and federal funds. And, if you are influential enough, you can do what the Mayor of Jersey City is doing. He is turning over the streets of the city to the county for a few days or a few months until they are all improved and then the county will give them back to the city. In New Jersey they are going to get fifteen million dollars of federal money for a three million dollar state appropriation for the improvement of county roads. I think that is a good idea. It puts people to work on W.P.A. where they don't have to spend a lot of carfare going back and forth to the job. I wish we could do that in Camden.

MR. PECK: The State of Connecticut is doing the same thing, and they will accept the improvement of any road for any city, with the understanding that the maintenance thereafter will be assumed by the city.

CHAIRMAN SHAFER: We shall open the meeting now for questions from the floor.

MR. FREDERICK T. PAUL (Minneapolis, Minn.): I have a question that came up recently in Minneapolis. I would like to know whether it is advisable to leave streetcar tracks in the street and fill up the grooves with an asphalt mixture, or to force the railway company to take them up and then repave the whole street. I would like to get the experience of some of you who have been confronted with the same problem.

MR. HARTMANN: We found that after the utility company relinquishes its rights in that streetcar line, and it has been properly passed on by the city commission, you will get better results by putting a binder of two and one-half inches over the entire surface, including the rails. As a rule you will find the rails are level and the tops higher, and the exact center line of the street will be higher. If you put a good two and one-half inch binder and a one inch top on it, you will have a very good street on a good sound foundation. They said it could not be done but it has been done very successfully in Camden and in Philadelphia. No preheating is necessary.

CHAIRMAN SHAFER: Do you use the tack coat?

MR. HARTMANN: Only to seal the edges where it extends beyond the binder. We level the binder off and if there is asphalt on the side we use an atomized coat there, very hot, and that is when the asphalt will feather-edge.

Mr. Paul: We have some high crowns that run six to nine inches. Do you cover the center of the street or just cover the track area?

Mr. Hartmann: Where we had Belgian block from curb to curb, we found it better to cover the entire street. Where it was asphalt shoulders instead of blocks, we found it expedient to cover the tracks and feather-edge out with a seal coat.

Mr. Collins: We are doing the same thing not only in the city but in the entire county. We think we have a very fine highway commission and on one of their main routes through our city they covered over the tracks without removing them. Of course, I can see the problem you are faced with when you have an unusually high crown. We do not have any excessive crowns in our city. Where you have a high crown and then put two or two and one-half inches on top of that, it is going to make a very dangerous condition as I see it.

Chairman Shafer: What are you planning to do, Mr. Paul?

Mr. Paul: We are experimenting and allowing them to fill in the grooves. I don't know how long the filler will stay in. This is the first time the company has not been willing to take up the tracks, but they say the tracks are not worth taking up. Unfortunately, under their franchise, the moment they stop operation of the streetcars it is not their problem any more. However, they have agreed to fill in the grooves with an asphalt mixture, but I am dubious about how long that is going to last.

Mr. Collins: We tried that in some streets and it lasted only a very short time.

Mr. T. R. Kendall (New York, N. Y.): I visited some dozen cities within the last year where that very thing has been done. Some of them were afraid of a high crown and they eliminated the binder course. The best jobs that I can recall of resurfacing over streetcar tracks are in Birmingham and in Jacksonville, Florida. In a number of cases I find that they paint the rails with a thin asphalt paint and fill the groove with a binder material which is hand tamped immediately. I can recall two places where that was done just before the resurfacing with the asphalt top with no binder course, and in that way they kept down the crown of the street. With hand tamping and some asphaltic material, not a cut-back, on the rail to build up a little more adhesiveness, there has been no trouble. In fact it has been very successful, as some of the streets I

saw had been down for two years with no sign of the rail. I inspected it very thoroughly, too.

MR. PAUL: I am glad to get as much information as I can on this subject.

MR. HARTMANN: If Mr. Paul is intending to resurface over the car tracks then I would suggest that he get the utility company to cut the groove in a sort of a flange to make a "V" shape and then he will not be bothered with a split rail. The most that can happen is that heavy traffic might cause a rail to work up and perhaps ruin a little of the pavement, but that is all.

CHAIRMAN SHAFER: Do you cut that with a torch?

MR. HARTMANN: Yes. They can save money by doing that. The money it will cost to do the work they will save in the material they salvage.

MR. DE WITT: We moved fourteen miles of track by W.P.A. labor. In a number of cases we moved the rails, filled in with concrete and immediately surfaced the whole street over the brick work and over the existing asphalt. It has been entirely successful.

MR. WALTER E. ROSENGARTEN (Ardmore, Pa.): I think when the surfacing is as much as two to three inches thick there should not be any trouble with resurfacing over the rails or old tracks. However, in Mr. Paul's case it seems to me he has a question of economics to be considered as there are some of the old streets with high crowns and in such cities the curb height is a problem that should be considered. It is questionable whether you are justified in resurfacing and maintaining that high crown and spending the money that is involved when sooner or later the street will need reconstruction. Therefore, it might be advisable to tear up the street and cut down the crown and rebuild it entirely.

CHAIRMAN SHAFER: You brought up a very vital question to us when you mentioned curbs. Under our city ordinance the curb and sidewalk is the responsibility of the property owner, but we are in trouble all the time about old curbs. Especially where we have had a lot of resurfacing, the curb reveal is nil. What is the practice in other cities about your curbs? Do you take care of the repairs to curbs on improved streets?

MR. ROSENGARTEN: The curb as well as the sidewalk is the responsibility of the abutting property owner. However, in order to improve the appearance of the streets, we have repaired the curbs with W.P.A. labor. We have used the granite curb generally in-

stead of other types, as we feel it adds more to the appearance of a residential section, which is the type of community in which I live.

CHAIRMAN SHAFER: In making repairs of curbs do you take out the old curb, that is, the twenty-four inches, and put in new curbs?

MR. ROSENGARTEN: If it is a granite curb the entire stone is reset to line. If it is a concrete curb it is simply a question of patching it if it has not gone too far, but if it has, then we take out the entire curb and reconstruct it.

CHAIRMAN SHAFER: Ten or fifteen years ago Pittsburgh used concrete curbs with angle line and guard. We have about fifty miles of that and we have received some complaints on it. And, in my opinion the property owners have a just claim that it was inferior work. We are faced with that problem on fifty miles of our curbing.

MR. STUART M. WEAVER (Montclair, N. J.): I have been very much impressed with these very thorough methods of covering car tracks wherein you go in and put down a couple of inches of binder and an inch and one-half top, but I was wondering where all of the money was coming from. Many miles of car tracks may be abandoned in a city, but if the rest of the pavement is good I can't see how you can justify the expense of covering the whole pavement. Furthermore, you can't hump it up in the middle. I have seen grooves filled and I am well aware that they don't stay filled, but if you write off the investment on that thing in a short time, or consider the interest on the investment, you can fill those grooves quite a few times in the course of a year and still be money ahead. I am also well aware of the fact that it is not the best way to do it, but I do know it is inexpensive. I also realize that it is hazardous because the filling does not stay in, but it is not as hazardous as it was when the car tracks were in use.

I can recall in one instance in particular where the grooves were filled on a very important thoroughfare and stayed in quite well. I have seen abandoned tracks covered with sheet asphalt with no binder under it, where the crown was not excessive and it was permissible to put an inch of cover over the car track, and that was on a highly traveled thoroughfare. While the good old conservative way of doing things is sure and pleasant, I don't know how you are going to finance that kind of a thing.

We have heard a lot about sheet asphalt. After all there are kinds of bituminous pavement other than sheet asphalt. Does anybody use bituminous concrete? That is a real field. We don't have the

problem they have in Camden where the asphalt ends up in the gutter in about twenty years. It seems to me sheet asphalt is a thing that has taken precedence in ordinary public construction because the makers of bituminous concrete had a patent, or thought they did, and everybody tried to avoid trouble with them and tried to perfect something else to do the job. That patent has long expired if they ever had one, and I think it is time to consider the use of bituminous concrete. It certainly is not as susceptible to cracking and shoving.

MR. HARTMANN: If we can buy it at a little over a dollar a ton delivered on the job, we will use that type of paving, but in the meantime Camden, like all other municipalities having their own asphalt plants, uses sheet asphalt because it is cheaper to lay, and from the experience we have had with it so far we find that it holds up rather well.

Also, if you have your own asphalt plant, it won't be difficult to have a W.P.A. project put forth all the labor, except that of operating your plant and delivering the material on your trucks, which materially lessens the cost of the sheet asphalt on the job. And there is no doubt but what sheet asphalt does look nice when it is put down.

We had a W.P.A. project which enabled us to cover our car tracks. We figured that if we kept these men on relief it would cost the city more than to have them work and repair the streets. We took into consideration the economic viewpoint as well as the practical viewpoint.

MR. PECK: Whenever we investigated the cost of bituminous concrete, it has never been quoted quite as low as sheet asphalt. We are not too anxious to press the point, because we have many streets from twenty to forty years old of sheet asphalt in really good condition, and we have not had the trouble some places have had of its crowding to the gutter. We have had such good results with it that we feel we should leave well enough alone.

MR. WEAVER: I think you are pretty lucky. Detroit is supposed to have a good sheet asphalt expert and so is Chicago and a lot of other cities, and I have seen plenty of their sheet asphalt shoving and cracking and going to pieces. You apparently have a local material that is particularly adaptable to the manufacture of sheet asphalt, whether it is your sand or what, maybe nobody knows, but I know everybody else has had plenty of trouble with it. There is no reason why bituminous concrete should cost more than sheet asphalt,

and I presume it does because it has not been put out in mass production.

There are a few such jobs in Utica that have been down for a good many years and they are still in good condition. We also have some in Montclair and there are a good many roads in the middle west that are still in good condition. I think in general they are more dependable than sheet asphalt.

CHAIRMAN SHAFER: We use a great deal of that bituminous concrete on our grades, as we found that it holds up a little better from the standpoint of pushing, and it will run no more than our binder. Our sheet asphalt costs more than the bituminous concrete and we are using that a good deal. Where we put an inch or an inch and one-half on old roads and don't want to put sheet asphalt on as a top because of its slipperiness, we use bituminous concrete. We call it asphaltic concrete.

MR. PAUL: We found back in 1906, with our climate ranging from thirty below to about one hundred and six above, that we had to get away from the sheet asphalt. We have found that it is more economical to put in a brick gutter six feet wide, not because of the shoving, but because of the softening of the asphaltic concrete, and we are doing that in our downtown district or wherever there is very much parking. It is working out very nicely. I will say that if we could buy sheet asphalt for a dollar a ton delivered on the street, we might be interested in sheet asphalt. I would like to know where that can be done.

CHAIRMAN SHAFER: Sheet asphalt costs us around \$5.50 to \$6.00 a ton to produce. That figure includes plant overhead and equipment, maintenance, etc. We can turn out bituminous concrete at a price varying according to the mix from \$4.00 to \$4.50. We can buy some of the cold mixes, as we are doing on the W.P.A. work, for as low as \$4.64 a ton, and that is what we call our W.Y.-1—a cold mix with about six to seven per cent bitumen content. The contract calls for three to six depending upon the conditions. The binder costs us \$4.64 and the top \$5.30, and we can buy asphaltic concrete for \$5.50 for the binder and \$6.00 for the top, so the price is not off very much.

MR. HARTMANN: Using the finest grade asphalt specified by the State of New Jersey and using W.P.A. labor, we can produce, lay, distribute, and spread 120 tons of asphalt top any time for less than \$500.

Mr. De Witt: In Utica we are using asphaltic concrete almost exclusively to get away from the Warrenite. In connection with the car tracks we have some streets from which the rails have been removed which have not yet been surfaced, just waiting for such time as we can afford to complete the work.

Mr. Weaver: Ann Arbor, Michigan, did a nice job of covering their rails without using binder, and with a minimum thickness. If you are interested in something of that kind you might write to George Sandenburgh, City Engineer.

Chairman Shafer: What did they use?

Mr. Weaver: Sheet asphalt.

Chairman Shafer: Has anyone here had any experience with Kentucky rock or Albany rock, either the hot processed material or the cold mix?

Mr. E. L. Knebes (Milwaukee, Wis.): We laid about a mile of a street sixty feet wide of one inch Kentucky rock this year and I will tell you ten years from now how good it is. We had one other job about a fourth that size which has been down for about two years and has worked out very satisfactorily. That is on an old concrete pavement.

Chairman Shafer: That is very expensive. We are paying approximately $16.00 for the natural rock and $14.70 for the processed rock per ton.

Mr. Knebes: I think our price was around $9.00 a ton but I am not sure.

Chairman Shafer: They claim they can put a half inch down and it will outwear an inch of sheet asphalt.

Standards of Municipal Street Lighting

Ellsworth Francisco

Engineer in Charge, Bureau of Lighting, Newark, N. J.

The subject of artificial illumination on our public streets and highways at night is a phase of our human welfare that is given entirely too little consideration, especially by many of our municipal governing officials.

Someone has said "Lighting is obvious." Except to those of us

engaged in the practice of lighting, it appears that this is the general conception. However, as it applies to street lighting, most of us believe that some lighting should be provided, especially on our urban streets, but the necessity for and the value of adequate illumination has not yet become obvious.

The basic purpose of street lighting is to provide visibility after dark. It is a protective necessity and indispensable in promoting safety, comfort, and convenience to the users of streets and highways at night.

Street lighting has been performing this beneficent service to humanity since the early days of the world's history, when the wayfarer at night, we are told, carried a torch of resinous woods to light his way and enable him to see his adversaries and protect himself from attack. If mankind found it necessary to employ light for visibility and protection in the early days, wouldn't you say that certainly street lighting today must be absolutely indispensable?

The necessity for adequate visibility, especially on our urban streets today, is very aptly described by R. E. Simpson in *Public Safety as Affected by Street Lighting.* He says:

> That part of our conduct that is governed by necessity—gaining a livelihood—and that part of our conduct that is governed by choice—seeking pleasure—so overlap that we require approximately 18 hours of the 24 each day in order that all of our activities may be accommodated. This means that our streets and highways are points of constant activity during three-fourths of the day. Unfortunately nature does not permit us to employ and enjoy the benefits of daylight during the entire 18 hours. Since good visibility is of prime importance for the efficient and safe conduct of human affairs, nature turns over to man, with the setting of the sun, the task of providing the means by which we may have enough visibility to carry on life's activities into the night hours.

In the past, we have been stressing the traffic accident prevention value of street lighting and only passively referring to its fundamental purpose, which is to provide visibility at night. The inevitable benefit resulting from adequate visibility is, in addition to the many other functions performed, the prevention of such traffic accidents and deaths as are due to insufficient visibility. It is just as vital to be able to see clearly at night as during the daytime.

Since the advent of the automobile, the tremendous growth of vehicular traffic and the development of streets and highways to facilitate the movement of this traffic have created a need for seeing that has not been given due consideration. Whether by day or night,

seeing, in order to provide safety, must be done quickly and with certainty. Time intervals of less than one second may mean the difference between life or death.

The science of seeing and its applications provide adequate proof of the value of adequate light and proper lighting in increasing safety on streets and highways. Motor vehicle accident statistics tell the sad story of poor seeing in losses of life, limb, and property. These statistics emphasize the need for the application of the science of seeing and in a very practical manner they support the logic and philosophy necessary to translate this science into its beneficence to humanity.

Much has been written on the safety phase of street lighting, but by no means too much. Constant emphasis is necessary. Despite all the educational effort that has been and is being expended by organized safety agencies and the very commendable work that is being done by our magazines and the public press, especially the latter, in putting safety messages constantly before the public, traffic accidents and their resulting deaths, serious injuries, and economic losses continue to mount higher. This does not mean, however, that this educational work may as well be abandoned. Who can guess what the terrible toll in human lives would be if there were no more warnings?

The *Municipal Index* in its 1938 edition publishes this comment by Arthur J. Sweet on "Lighting Safety."

> Competent analysis of available statistics discloses that adequate urban street lighting throughout the United States would, in 1937, have prevented 4,000 traffic fatalities, together with property losses of $200,000,000. This is not an irresponsible claim. It is a conservative understatement of fact, fully substantiated by the record.
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> America's entire street lighting expenditure for 1937 was less than one-third as great as the property losses due to inadequate street lighting. It has truly been said, "The public pays for adequate street lighting whether it gets it or not." As a matter of fact, the public is now paying in property losses very much more than the cost of the better street lighting which would prevent those losses, to say nothing of the payment in human suffering.

Although street lighting service is one of the elder members in the family of municipal services, it is yet the least standardized. Evidence of this situation can be found by the wide variation on the types of fixture equipment, sizes of lamps used, height at which

lamps are mounted over the street, maintenance of the lighting systems, and the number of lamps installed in a given length of street in our various municipalities, notwithstanding the fact that street uses and traffic characteristics are essentially the same and that the fundamental purposes to be accomplished are almost identical.

This situation is the result of the lack of proper planning and the incorrect application of the fundamental principles of the science and art of street illumination in the past. In other words, generally speaking, our street lighting systems, like Topsy, "jes growed." Unless street lighting systems are properly planned, installed, operated, and maintained, they will not function either efficiently or economically. With some exceptions, street lighting has never kept pace with traffic requirements and the development of streets and thoroughfares.

It has been reliably estimated that the general deficiency in the amount of street lighting in this country on our municipal streets, in 1930, was about one-half that needed to provide the visibility required for safe use of our streets at night. The general curtailment of this service during the few years immediately following 1930 is a familiar story. While there has been considerable recovery during the past three or four years, it does not appear that we have totally recovered much beyond our 1930 service.

Thus, the major fault with the average street lighting system, today, can be summed up in one word—"inadequate"; inadequate amount of light, inadequate application of the fundamental principles of street illumination, and inadequate planning.

In fairness it must be stated that there are notable exceptions to the general conditions just briefly described, not only in specific installations in many municipalities but in several instances where cities have completely revamped and standardized their entire lighting system in accordance with proper planning. What these latter cities have done is the final remedy that should be applied to correct our present general street lighting situation.

If we believe the old proverb, "Where there is a will there is a way," then there is an element in the remedial formula that is, perhaps, more important than the mechanical process necessary in the standardization of street lighting systems. This element is a comprehensive realization of the true value and the necessary functions of street lighting on the part of the municipal governing officials and engineers responsible for providing this service on our

public streets and highways. When this obstacle is overcome, ways and means invariably appear.

After this first step has been hurdled, standardization becomes an engineering problem requiring a competent determination of an ultimate street lighting plan. This plan involves a complete survey and zoning of the municipality and the complete design of an entire lighting system that gives due regard to types of streets and their traffic, the characteristics of street paving surfaces, the types of buildings along the street, and the presence or absence of trees.

Vision, as involved in street lighting, is a complicated phenomenon. For sure and comfortable seeing, satisfactory lighting conditions are required, including adequate horizontal and vertical illumination, adequate and well distributed brightness of pavement surface, and absence of glare. In view of the complexity of the problem, it must be evident that the effectiveness of street illumination depends upon the skill with which the flux from the light source is applied.

Until a "Code of Street Lighting" was issued by the Illuminating Engineering Society of this country, location of street lighting units in accordance with political preferment or the commercial aspirations of the utility company furnishing this service, was common practice. Fortunately, when these standard specifications became generally available, the excuse for this hit-or-miss method of making installations began gradually to disappear, with the result that effective lighting, in accordance with the specifications contained in this Code, is now the rule rather than the exception. It should be noted, however, that this progress applies to new installations and not to a general improvement in the status of older installations, except as previously mentioned.

Perhaps it should be pointed out that these standard specifications were prepared by the Illuminating Engineering Society's Committee on Street Lighting, composed of representatives from municipal and state governments, the United States Bureau of Standards, universities, manufacturers of street lighting equipment, consulting practice, testing laboratories, casualty insurance companies, and utility service companies. In other words, this Code is an entirely unbiased document and a competent guide for the correct practice of standardized street illumination.

We have purposely refrained from entering into a technical dis-

cussion of the topic before us for consideration; first, because we believe that the majority of you find a discussion of the general status of street lighting more interesting than listening to a dry, technical discourse and, secondly, because the time at our disposal would not permit us to cover amply the technical phases.

DISCUSSION

ARTHUR J. SWEET

Consulting Engineer, New York, N. Y.

I AM A realist. I am, moreover, an old-time American, not hesitating to speak out bluntly even though to do so may arouse the bitter wrath of powerful commercial interests. As a realist and as a forthright American, I wish to ask an embarrassing question of those of you who have some responsibility, complete or partial, for your city's street lighting practice.

Why don't *you* champion better street lighting for your municipality? This is not a rhetorical question. It is a real question addressed to each of you personally. Face that question and, within yourselves, answer it honestly.

I am going to answer that question for you. Self-interest will deter most of you from publicly admitting that I have answered it truly, but deep down in his own heart, each one of you who has any degree of direct connection with street lighting will know I have spoken the truth.

Mr. Francisco assumes that you fail to champion better street lighting because you don't adequately appreciate its importance and social value. I say to him and to you, "That is not the reason."

Many of you will honestly answer, "I don't champion better street lighting because my city cannot afford to increase its street lighting expenditure." To any such I say, "You can at least double the effectiveness of your street lighting service without any increase in annual expenditure. Furthermore, you can establish beyond challenge the truth of this statement at the relatively trifling cost of a demonstration installation of two or three blocks." Such a definite statement from a man of reputable standing in the street lighting field cannot be dismissed as irresponsible; yet, in making it, I am quite aware that not one of you will be led to champion better street lighting by the fact that it can be had without increase

in expenditure. By your actual reaction to my statement you prove that cost is not the true barrier, even though you may fool yourself into believing yourself sincere.

The real reason you don't champion better street lighting is because you believe it will not be to your personal interest to do so.

In most of the cities from which you come, street lighting is furnished by a privately owned public utility. That utility is a power in politics. The utility would like to have you increase your street lighting expenditure, but other demands upon the taxpayer's dollar deter you from improving your street lighting service by that means. The only way to improve your street lighting service without increase in cost is to expose the extravagance and waste in your present street lighting practice and to champion the kind of system and the basis of obtaining the service that will give the public the most for its money. Each of you knows, deep down in his heart, reluctantly confessed even to himself, that, if you seek better street lighting by that course, you stand a considerable chance of losing your job. It's unhealthy for you to champion better street lighting. I'm not blaming you. I'm just looking the facts squarely in the face.

Some years ago, the head of the street lighting department of a large company selling street lighting equipment said to me, "When we get a request from a public official or citizen committee for street lighting advice, we defer replying until we know what the local utility wants to install: for we have learned that, in most sections of the country, the public will have no real influence in determining the type of system employed."

If the social system were static, it would be a complete waste of time for Mr. Francisco to talk to you about the importance of better street lighting or for me to say what I have said. Fortunately, the situation is not static. Faced by a rising public resentment over their unsocial influence in our political life, the utilities are beginning to change their street lighting policies. The more far-sighted utilities—the Consolidated Edison Company of New York is one example—are beginning to divest themselves of ownership of the street lighting system and to withdraw from their unsocial overlordship in this field. The time is not far distant, gentlemen, when you are going to handle street lighting as freely as you now handle the water supply or the sewage disposal problems. That is the essence of my message to you.

I feel, in short, that it is really a waste of all of our time to plead

with you—and this is based upon twenty or twenty-five years in this particular field of specialization. We can't expect you to do something we know you can't do without at least a serious fight on your hands and without gravely imperiling your employment. It is hopeless to expect many men in the field to go out and be martyrs, and the one hopeful thing in the situation is the fact that, due to a variety of causes, the effects of such unsocial policies have been observed and in time there will be a change.

By intelligently facing these facts, you can very materially advance the coming of the better day. You will find it worth your while seriously to study the problem of how your city should expend the street lighting dollar to obtain the maximum in service. Under a changing social situation, you will find increasing opportunity to apply your better understanding of the problem to the advancement of the public interest.

W. T. Blackwell

Public Service Electric and Gas Co., Newark, N. J.

Mr. Francisco in his paper referred to the effect that lighting would have on accidents. Recently the New York State Highway Department has conducted a number of experiments in order to determine definitely how much reduction in accidents would occur through the installation of adequate street lighting. The State Highway Department is cooperating in rather an interesting way with the municipalities in lighting the highways that enter such municipalities.

Prior to June, 1937, whatever lighting there was on the highway was usually provided by the municipality. This resulted in all kinds and sizes of lamps, and frequently in no lighting at all in the smaller communities, the state's policy at that time being to light only bridges, overpasses, traffic circles, cloverleafs, and other similar structures.

We have in New Jersey an official organization known as the New Jersey League of Municipalities. That organization, through its Committee on Safety, formulated the code of street and highway lighting to which Mr. Francisco referred, and it also took a very active part in the negotiations with the State Highway Department to relieve municipalities of the expense of lighting the highways

traversing their cities. Some of these municipalities were spending a very considerable sum of money. Finally, the State Legislature made available to Commissioner Sterner of the Highway Department a fund of $150,000. After this money was provided, the Commissioner set up some ground rules regarding expenditures. He announced that he would be willing to undertake the continuous lighting of highways where the accident experiences justified such lighting and where municipalities would bear a certain share of the cost. This policy was very acceptable to the municipalities and lighting is going in every single day. It has been going in every day since about the middle of November when the policy was announced, so that at the present time there are upwards of 400 miles of lighted highways in New Jersey—a mileage which I think I am safe in saying is greater than all of the highway lighting in all of the other states of the Union.

This policy of cooperation with the municipalities is producing such good results that I think it is worthy of your consideration. Roughly, the State Highway Department, in order to make its funds go as far as possible, will provide a theoretical 2500 lumen lamp and the municipality will pay for the difference in cost for a 4000 lumen lamp, and in some instances a 6000 lumen lamp. One of our principal highways in New Jersey is Route 43, known as White Horse Pike, running from Camden to Atlantic City, 58 miles in length. It is lighted continuously throughout the entire length, and there are many other substantial stretches of lighting.

Commissioner Sterner provided traffic counters at strategic points on four or five stretches of highway and had the traffic counted for 24 hours a day. Coincident with that, automobiles containing two men patrolled that district, working on eight-hour shifts, in order to get an accurate record of the accidents that took place. It was found that the accidents reported to the municipality through the local police and through the state police represented only 57 per cent of the actual number of accidents that took place on the highways. This was on Route 25, which I think is one of the busiest highways in the world. It carries an average of 60,000 vehicles a day, and has been known to carry in 24 hours as high as 102,000 vehicles.

That road was selected as a testing ground to determine how much light was required. They installed 4000 lumen lamps 400 feet apart on the center line of the road and mounted 25 feet high

with brackets long enough to bring them out over the pavement. And, contrary to the remarks of the previous speaker, the State Highway Department selected the type of unit, mounting height, and spacing unit.

This lighting was continued in service for a period from August 1, 1937, to October 1, 1937. As accurate records are available for the same period in 1936, comparison showed the following: day accidents in 1936 for the period mentioned, 82 non-fatal and one fatal accident; at night, 20 non-fatal and no fatal accidents, with an average volume of traffic of 44,500 vehicles during a period of 16 hours. The same road for the same period of time in the following year shows for the day accidents 56 non-fatal and no fatal accidents. The night accidents were 28, showing an increase, and the fatalities were one, with a traffic volume of 50,700 vehicles for a period of 16 hours. The traffic had increased 13.6 per cent in one year and the night accidents had, of course, increased 40 per cent. That indicated clearly that 4000 lumen lamps on 400 foot centers on that highway were not effective. They tried another experiment and doubled up on the lamps, putting in 2500 lumen lamps spaced at 200 feet apart. They were in service from January 1 to June 30, 1938. The previous record for that same period showed for the daytime 56 accidents with no fatalities, and at night 51 accidents with two fatalities. There was a 24-hour volume of 63,000 vehicles. The accidents for that same period this year jumped to 60 with two fatalities in the daytime, and at night increased slightly from 51 to 56 with no fatalities. The traffic volume increased to 70,200 vehicles in 24 hours. The traffic volume increased more than 10 per cent and night accidents increased 9.8 per cent. The third part of that test is now in process. The lamps have been increased to 4000 lumens.

There was another test being carried out on Route 4 which runs from the George Washington Bridge toward Paterson. The unlighted section of that road from January 1 to June 30, 1937, showed 60 day accidents with one fatality, and the 51 night accidents with three fatalities, with a 16-hour traffic volume of 55,500. It was lighted on January 1, 1938, and the count was taken until June 30, 1938. The day accidents increased to 71 with three fatalities and the night accidents dropped from 51 the previous year to 34, with no fatalities. There were several other tests which I won't take the time to tell you about, but they all corroborate what Mr. Francisco has

said. In short, Commissioner Sterner has been conducting an outdoor laboratory, you might say, and the State Highway Department is absolutely convinced that a possibly overlooked method of reducing fatalities in accidents is adequate lighting. It actually represents a very small percentage of the tax dollar, and I think that there are many items that could be curtailed without the loss of life and without the economic loss involved in a curtailment of street lighting.

F. Victor Westermaier

Philadelphia, Pa.

The point brought out by Mr. Francisco is essentially this: Street lighting is necessary if you want safety. Safety should come before comfort and convenience. There was a long period when street lighting equipment was sold on appearance, but that day has now passed. Now, because of the condition of municipal finances it can be sold only on the basis of the service that it renders.

As you engineers know, nothing is worth while unless it is based on a good foundation. Very little has ever been printed in textbooks on the science of street lighting. A branch of the membership of the Illuminating Engineering Society, which was organized essentially to study the engineering of illumination, a committee of men who were especially interested in the field of street lighting got together and are now known as the Committee on Street and Highway Lighting of the Illuminating Engineering Society. It consists of twenty-odd members, men in different walks of life, but all having a fundamental interest in this subject. After years of detailed study of the different types of street lighting and street illumination, this Committee has prepared for the engineering world two codes—a code on street lighting and a code on highway lighting.

A very prominent official not so long ago stated that the trouble with such committees is that they do not give enough publicity to the work they are doing. Therefore, I am glad that Mr. Francisco has been given this opportunity to inform those of you who have street lighting problems—and you all have them—that you can find their solution by a careful study of these codes.

F. J. Hartmann

Camden, N. J.

There is no question about the necessity for adequate street lighting. Not so long ago I sent out a questionnaire on this subject to over 10,000 people, and as a result of that questionnaire I believe I can say that the service rendered by street lighting departments is the least uniform of all the services rendered by a municipality. In other words, cities like Chicago, St. Louis, and Baltimore are successful in getting a midnight rate, while cities like Newark, Camden, Philadelphia, and New York do not have this advantage.

In other words, the municipalities are served by utilities who care little about uniformity; they are selling the service for what they can obtain from the municipalities rather than for what the service is really worth. And, if this conference and this American Public Works Association wants to take a step forward in adequate street lighting, one of the things for it to do is to propose uniform lighting so far as this concerns equipment, height of illumination, and uniformity in rates.

Sewerage Problems Resulting from Modern Developments

E. J. Cleary

Assistant Editor, Engineering News-Record, New York, N. Y.

Whenever you see a man wearing blue denim overalls, the chances are two to one that they were fashioned with cloth made in Greensboro, N. C. Now the manufacture of overalls may seem to be a long cry from sewerage problems—but not in Greensboro. With half of the country's production of blue denim concentrated in this city, and the wastes from the textile plants entering a near-by water course along with domestic sewage, a very acute stream pollution problem presented itself. And when the city decided to build a disposal plant to clean up the stream, it could not ignore the large volume of industrial waste. Accordingly, it was necessary to construct sewerage facilities and treatment devices of a special design.

Not every city is faced with a problem like that in Greensboro but this story typifies a general situation. In greater or lesser degree all cities have sewerage problems. And many of them are of a special kind, resulting from those technological, social, and economic changes which we commonly refer to as "modern developments."

Air Conditioning Requirements

Perhaps the most dramatic technological change that can be cited is the phenomenal development of and the demand for air conditioning. What has taken place is almost fantastic when we consider that only a few years ago, no one had the faintest notion that air conditioning requirements would profoundly affect municipal water supply and disposal facilities.

Leaving the worries regarding supply on the broad shoulders of the water-works man, let us turn to the matter of providing for the disposal of used water. Immediately our thoughts go to city engineer Loran Gayton of Chicago. Briefly, here is what he finds: Air conditioning installations in the Loop area have so overtaxed disposal facilities that the sewers in this district have frequently been flooded during the summer season and have overflowed into basements of buildings.

But Chicago is not alone in facing the critical situation of sewers proving inadequate for the demands placed upon them. In Lincoln, Neb., air conditioning became so popular that as far back as two years ago all the lateral sanitary sewers and part of the interceptor system in the downtown business area were running full. As a result, it was necessary to pass an ordinance requiring that all waste water discharged from air conditioners be turned into storm sewers. Fortunately, a new and extra large storm sewer system was available. Otherwise, Lincoln would have been no better off than Chicago is today.

Without instancing further cases, it should be clear what this technological change called air conditioning means. It is simply this: Many of our cities today are, or will soon be, faced with the necessity of carrying out extensive programs of sewer extension; and what is more, this will be a costly and complicated business because the work to be done is centered in the congested business areas of the cities. The use of storm sewers, where these are available, may help to simplify matters.

In places where sewage is treated, air conditioning waste water poses another problem. If this additional flow (and one survey in Chicago showed a volume of 26 m.g.d.) is passed through the plant, it puts a burden on pumping equipment, shortens the period of detention provided in settling tanks, and in other ways may affect the efficiency of treatment processes. This again points to the desirability of using separate storm sewers.

The Industrial Waste Problem

A second problem that the sewerage engineer must face—and one which looms larger every day—is the matter of handling industrial wastes. In the aggregate, industrial wastes contribute just as much pollution as domestic sewage—sometimes more. In other words, the construction of municipal treatment plants which accommodate domestic sewage alone only half solves the stream pollution menace. Just how are we going to tackle the other half of the problem?

No one can be so crass as to suggest that industry alone should and must provide the solution. This is neither practical nor expedient. Industrial establishments are an essential factor in the life of the community of which they form a part; among other things they pay taxes and justifiably they are entitled to community

services for which tax money is used. Part of this service, of course, is sewer service. While it is not implied that a municipality is obligated to treat all or any industrial waste that might be dumped into its sewers, it is proper that a municipality should assume responsibility for cooperating with industry in providing nuisance-free disposal.

There is no formula for this cooperation. What can be done is a problem of which the dimensions vary for almost every individual case. There are precedents, however, and a study of these may be helpful in arriving at a solution. Three cases come to mind:

Greensboro, N. C., previously mentioned, is one of the big textile centers of the South. Here textile wastes constituted one of the principal polluting agents entering the stream into which the city discharged its sewage. As a result of intelligent cooperation between the city and the mills, a municipal disposal plant has just been completed which includes special provisions for treating the textile wastes in combination with domestic sewage. The mills, incidentally, cooperated to the point of making a financial contribution to cover the cost of certain equipment installed primarily for textile waste treatment. The story of the plant and the detailed events leading to its construction was published in the September 15, 1938, issue of *Engineering News-Record.*

A second case likewise concerns a municipal and textile waste problem, but the solution was somewhat different. The locale is Durham, N. C., where an activated-sludge plant was installed a few years ago. In order that this plant could accommodate the waste discharges from some dozen mills in the city, consulting engineer William Piatt made agreements with the mills whereby they each installed devices for pretreatment of the wastes before they entered the sewer.

The final example concerns Cedar Rapids, Iowa, and the meat packing industry. Here an agreement was made with the meat packers whereby they paid for the installation and operating costs of a pretreatment plant adjoining the municipal disposal works. The purpose of the pretreatment is to render the packing wastes amenable to subsequent purification in the municipal plant. The agreement further provided that a certain percentage of the construction cost of the municipal plant was to be borne by the packers. The details of this unusual cooperative arrangement were outlined by Howard R. Green, consulting engineer of Cedar Rapids, in a

paper published in the *Sewage Works Journal* of November, 1937.

The point I wish to make in citing these cases is that no sewage disposal scheme today should be designed without regard for accommodating the treatment of industrial wastes. Present stream pollution abatement will be furthered only so far as we are able to remove industrial wastes as well as domestic sewage. And if communities don't work with their local industries toward this end, who will?

The Job Ahead

Mention of stream pollution naturally focuses attention on the powerful force called public opinion. Without dwelling on the events which have led to the molding of an enlightened opinion, the fact remains that today there is a well defined consciousness of the need for putting a stop to further degradation of our water courses. Some of this has been translated into legislative fiat; a great deal of it can be credited with having been the motivating force in the recent widespread construction of sanitary works.

Cities, therefore, are being compelled to bring up to date their sewerage facilities—and there are many of them in dire need of this kind of renovation. This is no ordinary job. For instance, construction of a treatment plant at so many dollars per million gallons of capacity is no measure of cost or of the magnitude of the undertaking. When a plant is built it usually involves, in addition to extension and repair of sewer services, the construction of costly interceptors as well. And if the existing sewer system should be of the combined type, a question can be raised concerning the economics of a separate system versus the cost of treating stormwater flows.

Another point which deserves emphasis is the selection of a period of use for which a disposal plant should be designed; this, of course, has an important bearing on the amount of money to be invested. There are so many variables affecting a decision of this kind that it is foolhardy to proceed on any undertaking without benefit of the most mature judgment and experience.

I know of one disposal plant, built in 1930 at a cost of about $250,000, which has never had a drop of sewage pass through it. The place for which it was installed was a rapidly growing community, but with the advent of the depression the industries around which the community was building were closed down. As a result

there has never been enough flow in the sewers to justify operation of the plant. This, of course, was the result of unusual conditions wherein even the best engineering analysis and forecast of future needs might have gone awry. Nevertheless, because of a change in economic affairs that was not foreseen, a quarter-million-dollar capital investment has been lying idle for eight years.

Also to be considered in making estimates of future needs is the fact that cities are no longer growing and expanding as fast as they did. Population increases have been gradually slowing up, and recent trends indicate that a stabilization point is not far distant. This is a factor of fundamental importance in the design of new structures and one with which the sewerage engineer must reckon carefully in planning improvements.

Since all of this discussion is bound up with economic considerations, it does not seem amiss to point out that when adjoining small communities are planning for sewage treatment the advantages of centralized disposal facilities in a single plant should not be overlooked. There are only two reasons why we don't have more of these joint undertakings—namely, politics and local pride. Both of these considerations are of dubious merit, but it cannot be denied that they do exert a powerful influence. There is no possible economic justification for the duplication of almost identical treatment facilities in adjoining towns, particularly when these plants (and I have seen examples) are located within a stone's throw of each other.

It is axiomatic that the financing of sewage disposal works is a problem, and this brings to mind the relatively new development in the manner by which such works are being financed today. I refer to the sewer rental system. The widespread acceptance of this revenue bond method of financing new work may be attributed to two conditions: (1) the unhealthy state of municipal finances during the depression period which made it practically impossible to float regular bond issues because of debt limitations; and (2) the acceptance of federal funds for projects which must be of a self-liquidating nature. Adoption of a sewer rental plan proved to be, in many cases, the only way by which communities could undertake the construction of badly needed improvements.

Strong endorsement and wide adoption of the sewer rental system is evident throughout the country. Engineers, therefore, will find it incumbent upon them to study and acquaint themselves with the application of this system of financing. There are many difficulties inherent in the establishment of rates, methods of determin-

ing equitable charges of services, and the collection of these charges. The public works engineer will be called upon to consider and advise on these matters.

Management and Operation

The final thought I have in connection with present day sewerage problems concerns the management and operation of disposal works.

This story will illustrate what I mean: In a certain town, the name of which is unimportant, splendid disposal facilities are now being completed. The engineers and constructors provided the best that modern science and skill can afford in the way of treatment process and equipment. Recently, the superintendent submitted to the city council a list of required personnel to operate the plant and a schedule of operating costs to be included in the budget. To this the council raised strenuous objection. They saw no reason why money should be spent for hiring skilled operators—"use prison farm labor," they suggested, "and we can save money."

It is situations of this kind which reveal the unfortunate fact that many well intentioned public officials consider sewage treatment to be about as simple as the operation of a cesspool. And I am afraid to mention what some taxpayers think. But one thing is clear. Too few people realize that a treatment plant is designed to perform a finely coordinated series of functions, and that in order to accomplish this the attention of skilled technicians assisted by a thoroughly trained staff is required.

There is a real job to be done here. First the public and certain municipal officials must be convinced that a modern million-dollar disposal plant cannot be operated on a penny budget; and second, when a new plant is under consideration, estimates covering ample operating appropriations should be thoroughly discussed so that when the plant is built no one will be shocked into such silly suggestions as to recommend its operation by prison farm labor. This is a problem involving public relations and education—a sphere of activity, incidentally, into which the public works engineer should project himself more forcefully if he is to gain proper appreciation and support.

The Situation in Brief

Taking a broad view of the situation today, public works officials concerned with sewerage facilities have three major problems on their hands. One of these, the result of obsolescence, hastened by

rapid development of air conditioning, involves the replacement and extension of sewers. A second problem is that occasioned by righteous public demand for the abatement of stream pollution. This means the construction and operation of disposal works, designed not only for treating domestic sewage but for handling industrial wastes as well. And it is in the design of these works to meet present and future demands adequately that special exercise of skill and judgment must be employed. The third problem concerns the financial and economic aspects of sewerage improvements. These, as never before, are matters of vital significance to the engineer.

The construction of sewers and sewage disposal facilities is big business to the taxpayers of this country—amounting to more than $100,000,000 a year. Only through conscientious recognition of the problems ahead can the public works engineer give assurance that this money will be spent wisely and effectively.

DISCUSSION

C. E. Keefer

Bureau of Sewers, Baltimore, Md.

Mr. Cleary, in his interesting and concise paper, has dealt with many timely problems confronting the sanitary engineer and the public. He states that "the public and certain municipal officials must be convinced that a modern million-dollar disposal plant cannot be operated on a penny budget." Unfortunately, in many instances sewage treatment works are being operated on budgets that are far from adequate. The weak point in our attack on the sewage treatment problem today is lack of funds for operation and maintenance. On the whole, sewage plants are being well designed by experienced engineers. Furthermore, the operators and the personnel at the majority of plants are competent and well trained. But with inadequate funds the best designed plant will fall short of what is required of it. A decided lack of economic budgeting is shown when a large sum of money is expended to build a plant that is complete in every detail and then insufficient funds are appropriated for operation. Many communities finance sewage treatment projects like the man who buys an estate for $100,000 and then spends only enough money to keep in good condition a place costing $10,000.

What measures can be taken to correct the present unsatisfactory situation? The public finances the operation of sewage treatment plants; the public, therefore, must be informed regarding the purpose of sewage treatment and the necessity of maintaining sewage plants in first-class condition. This task should be easier than it was fifteen or twenty years ago. The automobile now permits many people who formerly remained in the cities on Sundays and holidays to use streams and lakes for recreational purposes. If these waterways are polluted by inadequate sewage treatment, the health of the people will be endangered and their pleasure will be curtailed. The public therefore should be vitally interested in this important question.

How shall the public be informed regarding sewage treatment? There are many ways of awakening interest in this problem. The subject should be discussed in classes devoted to civics and science in our schools and colleges. Sanitary engineers should welcome the opportunity of talking on sewage treatment before clubs, associations interested in real estate development, Izaak Walton Leagues, and similar organizations. The newspaper, the radio, and popular magazines offer an additional means of disseminating knowledge regarding sewerage problems and in increasing public awareness of the many angles of the question.

The financing of sewage plant operation is of sufficient importance that the appointing of a committee, perhaps by this Association, to study and report on the best methods of solving this problem would seem warranted. It would seem desirable for such a committee to investigate the cost of different types of sewage disposal in various parts of the country. Recommendations as to the salaries to be paid sewage plant superintendents and their principal assistants should be included in the report. The committee might stimulate interest in sewerage problems by having prominent sanitary engineers give radio talks on this subject.

LORAN D. GAYTON

City Engineer, Chicago, Ill.

THE DISPOSAL of municipal wastes, both solid and liquid, has always been one of the most important, and at the same time one of the most vexing problems coming under the jurisdiction of public officials. At the present time, due to the persistent and con-

tinuing demand for a higher and still higher standard of living, and due to the technological development of equipment affecting the everyday life of the individual, this problem of the disposal of municipal wastes is becoming more and more complex, and more

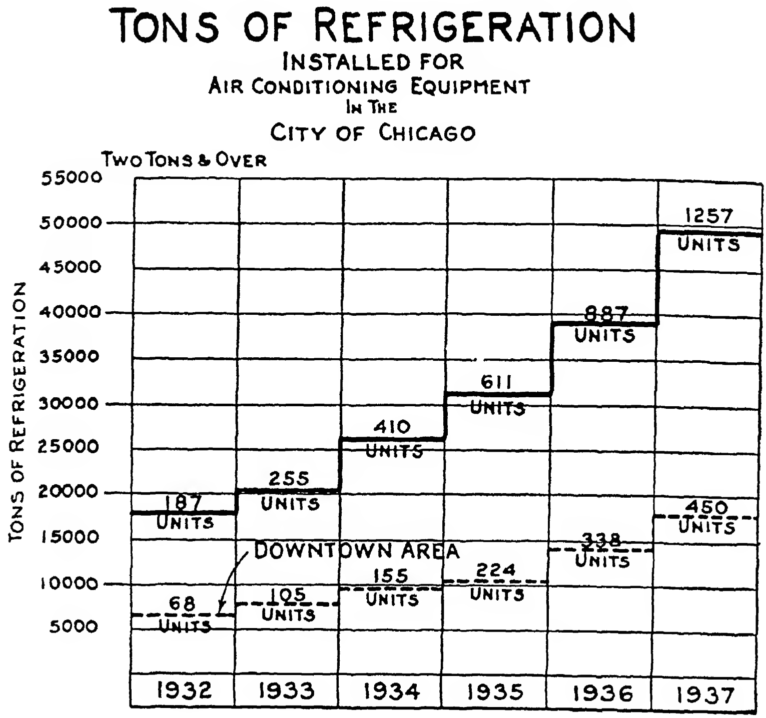

CHART 1

and more costly. Public officials find themselves faced with the necessity of making extensive and expensive changes in present disposal facilities, or in providing complete new and additional structures and equipment, and they are finding the problem very difficult of solution from both the physical and the financial point of view.

In my opinion the matter under consideration is of such great importance, not only to public officials but also to the general public, that I feel that the American Public Works Association has done a most worth while act in bringing this problem to general attention, and I am sure that we all agree that Mr. Cleary is to be complimented upon his most able presentation of the subject.

In order to illustrate and to supplement what Mr. Cleary has said concerning the effect of air conditioning upon sewers and sewage treatment, I should like to present a few charts indicating the amount of water demanded by air conditioning equipment in the central business area in Chicago.

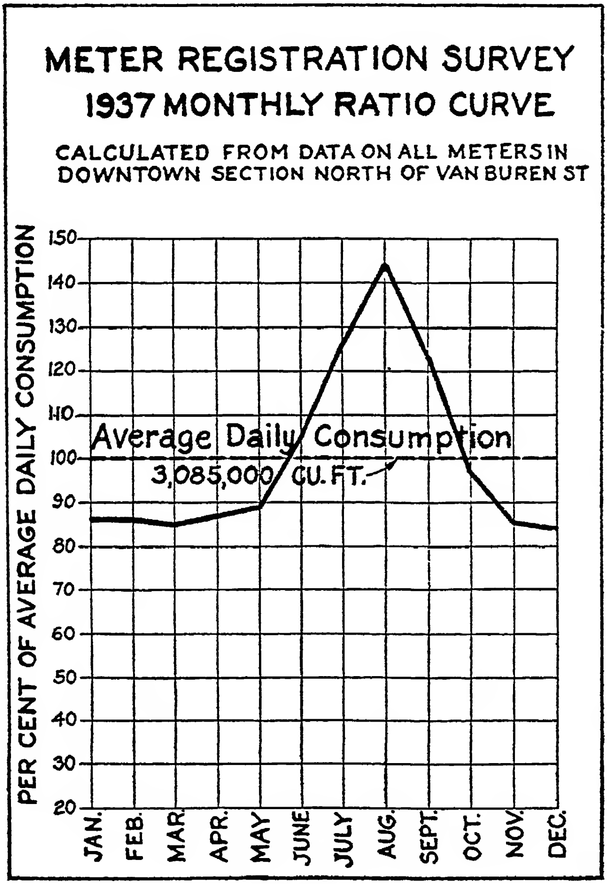

CHART 2

Chart 1 shows the increase year by year from 1932 to the end of 1937 of air conditioning equipment in the entire city.

Chart 2 shows the total amount of water required for air conditioning in the central business district for the years 1935, 1936, and 1937.

Chart 3 shows the amount of water used for all purposes in the central business section of Chicago for the year 1937.

Chart 4 shows the amount of water used during 1937 in the central business district of Chicago—curve A, showing the water used by

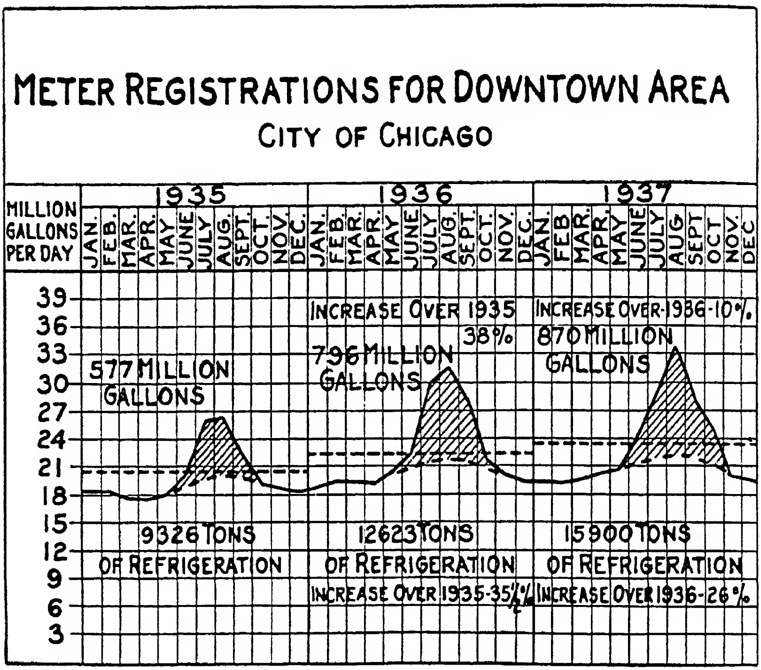

CHART 3

premises having installed air conditioning equipment—curve B showing the water used by premises having no air conditioning equipment.

Chart 5 shows the water used for all purposes in one block in the central business district of Chicago for the years 1935, 1936, and 1937. This chart also shows the amount of air conditioning equipment installed in this block for the same years.

The table on page 289 shows a summary of air conditioning statistics for the same block. At the end of 1937 there were 196 tons of air conditioning equipment installed in this block, whereas if the entire usable volume of the block were air conditioned it would require 3,731 tons.

Now as to the effect of this tremendous amount of water upon the sewers of the central business district.

It is true that the sewers of the central business district have been inadequate, as far as the storm run-off is concerned, for many years,

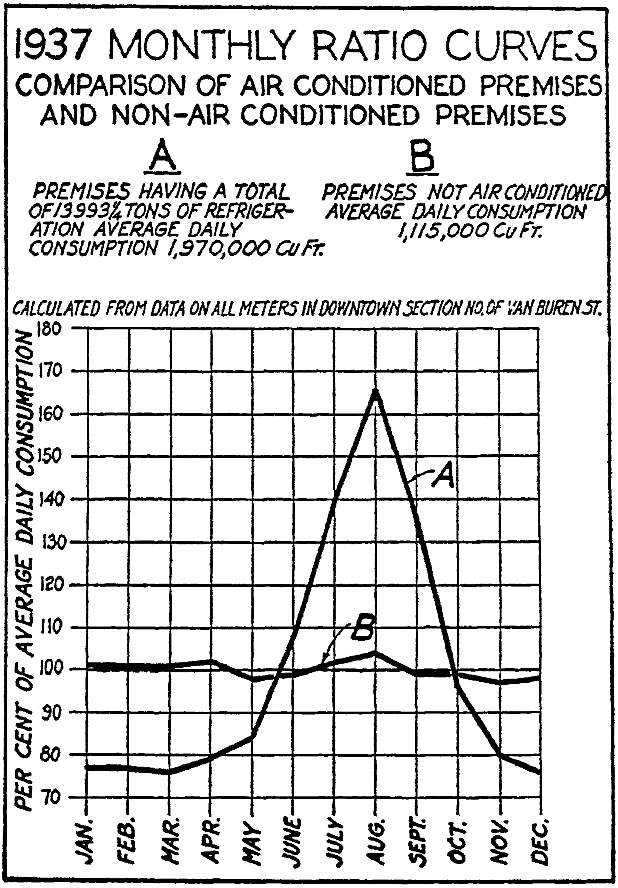

CHART 4

and many plans have been developed for enlarging them, but the addition of the water from air conditioning equipment will greatly increase the cost of bringing them to proper capacity. Plans have been prepared for a sewer system of sufficient capacity to handle the air conditioning water in addition to the normal domestic and

storm run-off, and it is estimated that this new system will cost between four and five million dollars.

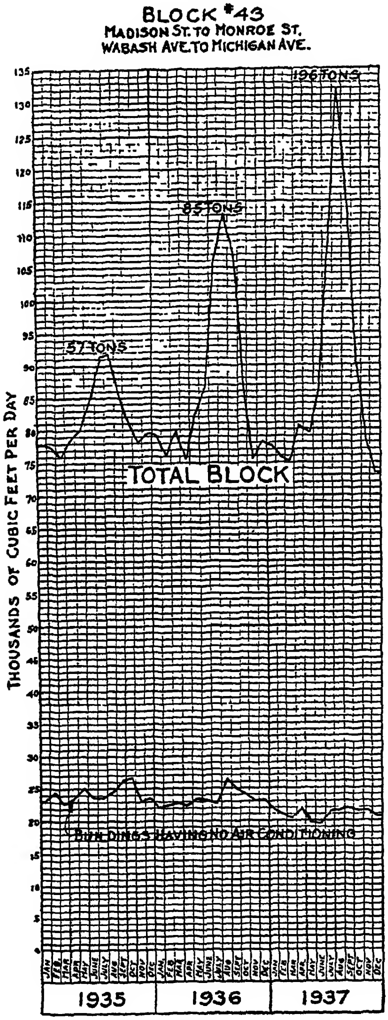

Chart 5

The Chicago Sanitary District, which has jurisdiction over the treatment and disposal of sewage in the Chicago area, has just completed a large program of intercepting sewers and sewage treatment plants. The air conditioning water is already having an effect upon the operation of these plants. Most of the air conditioning is in the loop area and this excess cooling water goes to the west side plant, which handles the area between Fullerton Avenue on the north and Roosevelt Road on the south. The Sanitary District engineers estimate that air conditioning places an additional load of 35,000,000 gallons per day on this plant during the hot period of summer. This is a peak load superimposed on the normal increase expected in hot weather. As the west side plant now has a total load of 325,000,000 gallons per day, this air conditioning increase amounts to approximately 10 per cent of the present total load and will probably grow faster than the normal increase due to population. While this water is practically clean, it has to go through the aeration tanks and will soon require more such tanks. It adds to operating costs for the reason that all this water must be lifted approximately 68 feet.

SUMMARY OF OCCUPATION BLOCK #43

	CU. FT.	TONS A.C.	CU. FT. A.C.	ADDITIONAL TONS A.C. REQ.
BARBER SHOP	23615	13	66720	5
CLUB ROOM	429348	72	159092	195
CORRIDOR	2588968	—	—	—
DISPLAY ROOM	555386	—	—	111
DORMITORY	1112568	—	—	223
DRUG STORE	24300	—	—	12
FLORIST	27650	—	—	8
FURRIER	237000	6	56000	45
MILLINERY MFG.	153996	—	—	15
OFFICE	4222723	—	—	965
RECREATION	996370	20	109681	180
RESTAURANT	1278197	70	154456	700
SCHOOL	793023	—	—	264
STORAGE-STOCK	349046	—	—	—
STORE	2588515	5	51000	800
TAVERN	22500	10	18900	12
VACANT LOFT	1127038	—	—	—
	16530243	196	615849	3535
VOLUME AIR COND.	615849			196
TOTAL	17146092			3731

The foregoing indicates briefly the problems being presented by the rapidly increasing installation of air conditioning equipment to the officials and technicians responsible for the construction and operation of the sewers and sewage disposal plants in Chicago.

Paul Hansen

Consulting Engineer, Chicago, Ill.

Mr. Cleary has presented an excellent paper and a timely one which calls attention to new attitudes and new conceptions with reference to improved sewage disposal. Until a decade ago, sewage disposal was looked upon as something undesirable that a city might be forced to adopt to prevent damage suits. Today, proper sewage disposal is accepted more or less as a matter of course and there is a strong popular demand for the preservation of the cleanliness of natural bodies of water.

As Mr. Cleary pointed out, many sewage disposal problems are more or less complicated by the presence of industrial wastes. In times past, cooperation between industries and cities in meeting these problems has been difficult. The industries have been suspicious and municipalities have been fearful that handling industrial wastes

would call for a disproportionate expenditure of public funds for the benefit of industry. The more or less general adoption of a sewerage service charge has greatly facilitated an equitable distribution of the cost for handling industrial wastes. It is true that a development of proper measures for apportioning sewerage service charges to industry has its complexities, but these are not insuperable and generally can be worked out satisfactorily under any set of local conditions.

It has been found in a number of instances that a properly coordinated effort between the industry and the municipality calls for partial treatment by the industry. This is particularly true with reference to the packing house industry. Often the problem of sewage disposal directs attention of industries to the matter of reducing the volume and strength of wastes by modifications of processes inside of the factory buildings. Such modifications have sometimes produced a profit. Where they have not produced a profit, they have at least represented cheap disposal.

Mr. Cleary makes an excellent point of the importance of placing competent men in charge of the operation of sewage treatment works. Much progress has been made in this direction in recent years. Most of the larger works of the country are operated by technically trained engineers and these men have shown great enterprise in obtaining economical operation and in developing a market for dried sewage sludge as a fertilizer. Probably the sewage disposal experts of the future will be the men who have had experience in the operation of sewage disposal works. This has been the experience abroad, particularly in Great Britain, where the most prominent engineers in the sewage disposal field have been associated with the operation of sewage works in the larger cities.

With competent men in charge of sewage disposal works, the matter of enlargement of the works when needed can be properly met. In their eagerness to provide adequate capacity to meet reasonable future requirements, engineers have, in some instances, designed works of a capacity too large from an economic point of view. They have felt that it is better to have a plant that is too large, rather than too small, and they have recognized the popular reaction when a relatively new plant is up to its capacity. Sewage treatment works may be built so that additional units may be readily added. Therefore, it is not desirable to tie up investment for more than a relatively few years in the future, if we can be sure that the

operators in charge will be forward-looking and will develop a program for progressive enlargements and extensions as needed.

Mr. Cleary's paper takes stock of the present general situation with reference to sewage disposal and calls attention to some of the outstanding problems that confront engineers specializing in this field. I do not quite agree with him that municipalities should assume the burden of handling industrial wastes, but I do believe that there should exist an understanding cooperation between industries and municipalities, through which desirable results will be obtained at the minimum expense to all concerned.

Guy Brown

Engineer of Sewer Design, St. Louis, Mo.

Unfortunately, because of a cross-up in my mail, I did not know I was on the program until I was on my way here, so I did not have any time to prepare a formal discussion. One point that seems to me to be worthy of consideration is the problem presented here this morning of the disposition of air conditioning water. That seems to present quite a gloomy picture of relief sewers and additional disposal plants that are going to have to be built to take care of that situation.

However, I do not believe the picture is as bad as it has been painted, for the simple reason that about 90 per cent of the water can be recovered and used again. I have seen plants that had cooling towers on the roofs, or cooling towers in the basement, and they are working very satisfactorily. It seems to me it is time for the sewer engineer to get into the picture of air conditioning. The method used now is simply to estimate the cost of the water wasted and the cost of installing towers and recovering it, without taking into account what it will cost to get rid of the water. If it is going to cost more to get rid of the water by additional sewers and additional disposal facilities, then the city should step into the picture and require the installation of towers for recovery. In that way this great expense of additional facilities would be avoided.

LINN H. ENSLOW

Editor, Water Works & Sewerage, New York, N. Y.

THERE is another aspect of air conditioning water that I would like to mention. During the hot dry weather, and particularly in connection with activated-sludge plant operation, it is not so bad to have some of this water going down the sewer, because it freshens up the sewerage and gives you a better dilution in which to aerate. You have a greater amount of carrier of oxygen with an equal amount of organic matter.

Mark you, the organic matter in municipal sewers does not change appreciably from week to week. The average is about the same and if you have more carrier water or oxygen you are that much better off. In Chicago it amounts only to 10 per cent of the flow involved at the West Side Plant, and I certainly would not consider that a bad omen.

On the other hand the cost of sewers to carry that water is another proposition. Mr. Cleary covered the matter of industrial waste in sewers very well, but I was sorry he left out one thing that I think is very important and growing more so—the destruction of sewers and sewerage works by industrial waste, either directly or indirectly. A large number of cities are faced with that problem; Oklahoma City, Los Angeles, and Kansas City are a few of them, while at Fort Worth, where the packing plants are very near to the sewerage plant, nothing seems to happen. The time involved there is very short and there is no opportunity to produce a destructive effect on the sewers. However, in Canton, Ohio, they have had a lot of trouble on account of the steel mills.

The question of the community and industry cooperating to treat domestic and industrial waste jointly is a problem which will have to rest upon its own merits in the community involved. Some communities will agree that the community should stand the greater part of the cost and others will not. Mr. Cleary has pointed out the political angle as very important and I find that to be one hundred per cent true.

We can take Greenville, S. C., as an example of what I am speaking about. They have an ample sewerage for carrying the waste of eight textile plants. That sewer is not being damaged and

these plants have been using that sewer for some years. Then Greenville built a sewage treatment plant and now they find industrial wastes are playing havoc with sewage treatment. They do not yet know how this thing will be worked out. The industrialists have formed a committee and have agreed, as I understand it, to stand the cost of the actual treatment if the city will stand the cost of the initial structures involved. To my mind that sounds like a very sensible proposal.

The industry, for instance, will empty its sewage during the night and thus the sewer will be an industrial sewer at night and the sewage will receive industrial treatment during the night. Then in the daytime it will be a domestic sewer as it should be, for the domestic population.

Concerning the operating personnel of sewage treatment plants, I agree with Mr. Cleary that the matter of manning the plant should really be one big and important specification in the construction specifications of that plant.

Refuse Disposal in Small Municipalities

ARTHUR BONIFACE
Village Engineer and Manager, Scarsdale, N. Y.

THE DISPOSAL of community waste is an old problem. If we turn to the Old Testament we find that Moses, in the care of his people, commanded them to collect their refuse, take it outside the camp and bury it. Thus the value of sanitation was recognized and it was practiced even in those days.

Too much indifference usually prevails toward this problem of sanitation, but sooner or later in the life of the smaller municipality the governmental authorities must face the question of waste disposal and find an answer.

In such communities the problem often varies widely, both in character and scope. A method of disposal that might be permissible in a small industrial community would be entirely unsuitable for one of a strictly residential type; then again the quantities of waste

to be dealt with are usually small and the appropriations limited. It follows that the most competent judgment must be exercised in selecting the method to be employed in every particular instance.

The need for a well regulated, sanitary means of waste disposal usually develops when a growing community reaches its teens. Since incorporation of the town, the private collector or the individual citizen has disposed of household waste by feeding it to hogs or using it to fertilize his garden. The day arrives when such methods become impracticable and the sanitary expert must begin his work.

Invariably the problem becomes acute when objectionable conditions have developed over the years, and pride in the community is given expression, perhaps by a change in administration, or by the aims of a civic-minded group of citizens.

This discussion will not deal with waste collection methods, but it must be stated that the treatment given refuse at the source and the character of collection are nevertheless closely knit with the function of disposal.

It is conceivable that the collection of refuse could be placed under the control of one authority and its disposal in the hands of another. With the present limited methods at our command, however, such practice seems inadvisable; better place control of all such functions in the hands of a private contractor or make it the entire responsibility of the municipality—preferably the latter.

Methods of disposal in use today by small cities and municipalities are usually confined to one or more of the following:

1. Dumping on or filling in low lands
2. Burial
3. Feeding to hogs
4. Incineration

Before making any choice as to the method to be followed, a complete survey of local conditions is highly essential, bearing in mind that the two most important factors to be considered are the degree of sanitation that can be attained and the economy of operation.

Ashes and street refuse present only minor problems, as such material can be used for filling in low sections, creating park lands, or grading for future highways.

Organic wastes fall into a different category; improper treatment of this material may readily create a nuisance. The disposal of organic wastes by dumping, filling in low lands, or by shallow burial,

are methods to be chosen only if every precaution is taken to control the operation properly. Otherwise one of the main objects to be attained, that of effective sanitation, will be defeated and the economy expected may be turned into an expense by law suits. Nevertheless, under certain conditions and with proper control, such a practice may be followed successfully.

The feeding of organic waste to hogs can be made to satisfy almost all requirements, but hog farms are not always available to municipalities.

Incineration perhaps, is the most desirable of present-day methods, particularly if a plant of the high-temperature type is selected. The choice of a site for such works should, however, be made only after very careful consideration; otherwise legal proceedings again may cause unwarranted delay.

A survey made several years ago and presented at the Conference of Mayors of New York State in 1935 showed, with respect to garbage disposal, that of a total of 77 municipalities 34 per cent disposed of refuse by dumping or burying; 18 per cent by hog feeding; 6 per cent by part hog feeding and part dumping; 3 per cent by reduction and 39 per cent by incineration. The popularity of this last method is, therefore, apparent.

Ten years ago at the convention in Toronto there were presented to you the results of experiments made by one small municipality in disposing of its organic waste by fermentation. This method of disposal has great possibilities, in that it meets the requirements of both sanitation and economy. So that your recollection may be refreshed, a brief review of its history is here repeated.

At Florence, Italy, in 1914, there was constructed an experimental plant for refuse disposal which contemplated the reclamation of organic waste accumulated on farms, with a view not only to its salvage, but to increasing its effectiveness as a fertilizer. For this purpose two simple cells were built, each about eight feet square and ten feet in height. An opening in the top served for charging purposes, and a door on the side for discharging. Successful operation was dependent on the bacterial action of the micro-organisms developed in the fermenting mass.

Following these early efforts, a plant of 204 cells was constructed in Florence and successfully disposed of the wastes collected in that Italian city. In 1923, an eight-cell plant of practically the same design as then used in Italy was constructed in this country and placed in

operation the same year. Early operation of this plant did not produce the results expected, the residue or humus being only partially oxidized and the moisture content far too high.

A great deal of research work followed these early efforts in America, the results of which developed several important facts, among which may be mentioned the following:

1. That the character of American refuse differs greatly from European refuse, particularly with respect to its moisture content.

2. That American refuse, because of its components, produces an acid condition detrimental to the development of the biological processes.

3. That control of the Ph. in refuse by means of lime may be successfully established.

4. That in the design of a fermentation cell provision must be made to afford adequate aeration following the early or anaerobic stage of the biological cycle.

Predicated on the findings obtained by this intensive work, the method of operation at this American plant was modified, and thereafter highly satisfactory results were obtained. The time required to produce humus at this plant from the raw refuse is approximately 28 days. The plant is simple to operate, practical, economical, and free from hygienic dangers.

In recent years, further research has been going on in Europe in an effort to reduce the time element in the fermentation of house refuse. Plants for this purpose have been erected in Italy and in England and are now in operation. In these disposal works the cells are charged with raw refuse, bacterial liquor being sprayed on the mass as it is being deposited in the cells. The bacteria thus introduced hasten the breaking down and final oxidation of the mass and reduce the time cycle of the older process from 25 to 50 per cent. Any hastening of nature to perform her work means a lessening in the cost of plant structures and greater economy. Close touch is being kept with the plants of this type in England and in Italy and important developments in this method of disposal should soon be forthcoming.

This is a process of reclamation admirably adapted to the smaller municipality because of its simplicity, economy in operation, freedom from hygienic dangers, and the saleability of the end-product.

The waste matter of communities is usually treated as pestilential refuse to be disposed of in as short a time and as completely as pos-

sible. Sewage, until recent years, was so considered. Now we know how, after proper treatment, it is distributed as a fertilizer all over the country. There is as much wealth, or more, in garbage as there is in sewage and the utilization of its value should be one of our greatest endeavors.

DISCUSSION

Samuel C. Jacka
City Engineer, Lansing, Mich.

It is necessary that I confine my remarks to garbage collection and disposal in the City of Lansing, Michigan, rather than to "Refuse Disposal for the Smaller Municipality" as indicated in the program. My reasons for this are that Lansing collects no refuse other than garbage, and that we of Michigan dislike having our capital city classified as a "smaller municipality." We have reached an estimated population of 90,000. We feel that our garbage collection service is as efficient and satisfactory as may be found in the "larger cities" and we know that it has received favorable comment from engineers and officials of other places.

Lansing uses the can system of collection and while the can system has a few disadvantages we feel that they are far outweighed by its advantages. Collections are made twice each week from July 1 to October 1 and once each week during the remaining period. Collections are made every day from hotels, restaurants, and groceries in the downtown area and every other day in the outlying districts. A special pick-up truck is on call for additional service and for anyone requesting an extra collection. On September 1, 1938, there were 13,842 cans in service. Eight three-ton steel deck trucks are used, with two pickers and a driver to each truck. The average per truck is 225 cans per load and three loads per day.

After collection, the garbage is delivered to a central transfer station in the cans and transferred to a 10-yard special dump truck. It is then hauled 12 miles to the piggery which now holds the contract for the city's garbage. At present the city receives nothing for its garbage. There have been various contracts made with individuals for receiving this garbage in the past but none were found satisfactory and none lived up to the terms of the contract in so far as

payment was concerned. The present contract expires July 1, 1939, at which time the garbage will be disposed of at our new sewage treatment plant in a way that I will describe later.

At the present time when the garbage collection is heavy three dump trucks and two drivers are used for this 12-mile haul. Two trucks are on the road while the other truck is being loaded, and the drivers alternate on the third truck. During the winter when the collection is lighter, only one driver is necessary and only two trucks are kept in service. Steam coils have been installed in these tank trucks and before leaving the transfer station during the months that the garbage is frozen, steam is supplied in a sufficient amount so that by the time the garbage reaches the piggery it is fairly well thawed out. No paper, glass, or other refuse is allowed to be mixed with the garbage and residents of Lansing are educated as well as can be to this ruling. After the cans are dumped at the transfer station they are placed on an endless chain conveyor-type can-washer which has a capacity of 24 cans per minute. Before going to the washer the cans are inverted and passed over a cold water jet which removes particles of garbage. The can is then passed over nine separate water jets with water at 200° F. This water is kept at constant temperature by thermostatically controlled live steam, which is discharged directly into the water tanks which also are the pump suction well. During the winter when the garbage is frozen, cans are first passed through the hot water tank which thaws the garbage enough to permit it to be dumped into the transfer truck.

Due to the care in handling them and to their sterilization, our cans have much longer life than do privately owned cans. At the present time they last about three years. On the basis of a budget of $65,900 and with 13,842 cans in service as of September 1, 1938, the average can cost is $4.70 per year. A can rental charge of $1.50 per year is made for all cans. The money derived from can rental goes to the city contingent fund and does not come back to the garbage department budget.

In conclusion I wish to point out the advantages and disadvantages of our system. The disadvantages are:

1. Reloading and extra handling at the transfer station are necessary when cans are collected.

2. The investment of municipal funds in cans and collection conveyances is more than would be required for tank trucks. This

makes the tank system seem cheaper but when the private cost of cans to each householder is considered, the balance ought to be in favor of the can system.

Advantages of the can system:

1. A clean, sterilized can is provided at each collection and the disagreeable task of can washing in the home is eliminated.

2. Worn-out cans are promptly discarded; thus are avoided the nuisances caused by the premises being fouled by juices from leaky receptacles.

3. The municipality assumes the responsibility of keeping a proper can in service. When this is not done, there is a tendency for householders to use almost any sort of receptacle regardless of its suitability—boxes, barrels, tubs, crates, baskets, and the like—thus creating nuisances at the home and increasing the difficulty and cost of removal.

4. The furnishing of a tightly covered clean can reduces the fly and odor nuisances at the home to a minimum.

5. Tight clean cans preserve the garbage in fresher condition, thus rendering it much more suitable for hog feeding.

6. Tight cans reduce the nuisance caused by garbage spilled on the property and along the line of travel.

7. Can transportation reduces the nuisance from odors arising from the collection trucks.

8. Cans are thoroughly cleaned more easily than tanks.

Our present method of disposal is by hog feeding, and you are probably more familiar with that type of disposal than I am. I would like to discuss briefly with you our proposed method of disposal at the sewage treatment plant. Because we are collecting our garbage in cans there are no particular difficulties in transferring these operations to the sewage treatment plant. A separate handling building has been built adjacent to sludge digestion tanks. In this building platform facilities have been provided for unloading the cans and washing them, as before. However, in place of dumping the garbage in another truck for removal to the hog farm as was done heretofore, the material is merely dropped into hoppers beneath the platform which feed into two hammer-mill grinders. The ground garbage is then transported to the digestion tanks by means of pneumatic ejectors. The grinders, each with a capacity of six

tons per hour, are equipped with refuse traps which remove tin cans, tramp iron, and similar material. Spray pipes in the upper part of the grinder housing supply water for washing the garbage through the rotor and screen below.

The ejector tanks have a capacity of 200 gallons and are so designed that a charge of ground material (minimum moisture content 70 per cent) can be ejected for a distance of 150 feet through an 8-inch pipe. This pipe rises upward 16 feet so that the material will discharge into an open well above the digestor and from there drop by gravity into the tank. The valves for operating the ejector are manually controlled from a panel board on which are also located signal devices indicating when the ejectors are ready to be discharged.

While garbage has not been handled extensively at sewage treatment plants, we are anticipating no great difficulty. Laboratory and other experiments indicate that it is entirely feasible and the garbage disposal problem is solved forever. The increased gas production and the resulting savings in electric power will more than offset any revenue that might be obtained from the sale of garbage. In the case of Lansing, where no revenue whatever is obtained from sale, and it will be possible to eliminate three trucks and the 12-mile haul, a saving of at least $10,000 per year will be made.

Public Education as a Function in Street Sanitation

MATTHEW NAPEAR

Secretary, Department of Sanitation, New York, N. Y.

THERE is a virtue that binds all of us together at this time . . . that of civic cleanliness, in as much as it is the subject we are to study and discuss.

It is a long, long cry from the House of Burgomasters in New Amsterdam (now Borough of Manhattan) in 1653 to the Department of Sanitation in Greater New York in the year 1938. The street cleaning budget in 1699 was about $40 for the year. Last year, 1937, in New York City it approximated $29,000,000. But our present department with all its various angles, its large corps of workers,

its science and its efficiency, is just the evolution of the crude method of street cleaning prescribed by the Burgomasters of New Amsterdam in those days of long ago.

In the year 1789, the City of New York issued an ordinance prescribing that on every Friday from March 1 to December 1 everyone should cause the dirt from his yard, cellar, and the street in front of his premises to be gathered near the gutter before ten in the morning and have it removed before noon the next day, or pay a fine of five shillings.

James Culbertson, the High Constable at that time, had charge of this, but it seems he was not very successful in enforcing the ordinance because the Daily Advertiser of December 19, 1789, calls him thus to task in an editorial:

> "AWAKE THOU SLEEPER, let us have clean streets in this our peaceful seat of the happiest Empire in the Universe. That so our national rulers and their supporters may with convenience and decency celebrate a Merry Christmas and a Happy New Year."

How our ears do burn, for the echoes of those sentiments are still heard in the newspapers of today!

This editorial was printed 149 years ago when the population of New York City was only 49,401. Today, with a population of more than seven million, we strive to carry out the same ideas and concepts of our forefathers, that is, to maintain a clean and healthful city.

Before I proceed with a discussion of our own procedure in the development of a system of sanitary education, I'd like to tell you some of the facts relative to our department so that you may gain some knowledge of the background.

It is the duty of the department to sweep the streets, to collect and dispose of all the garbage, rubbish, ashes, and dead animals accumulated daily, as well as the abandoned automobiles and other encumbrances left on the city streets and in vacant lots. There is an average of 5,000 truckloads of ashes, garbage, and rubbish collected daily, to which must be added the removal and disposition of varying amounts of snow in the winter season for which special equipment has been devised and is ready for use. In every 24 hours, more than 107,000 cubic yards of waste material are collected. There are 12 incinerators in active use, with a daily rated capacity of approximately 6,200 tons, for the disposition of burnable materials, the re-

mainder being deposited in various land fills located throughout the Greater City.

Such, then, is the picture I wish you to bear in mind as we proceed to a discussion of the educational side of the program.

For the sake of a premise at the outset, may I be permitted to divide all of the people who make up the resident population of New York, or for that matter, any other great city, into three classes. First, there is a great body of them who are willing to learn and, further, are eager to carry out the lessons they have learned in a practical and efficient manner. Then there is a great mass of people who are diffident, but who, once they have been shown the benefits that accrue from added knowledge, are willing to learn and likewise to carry out the purposes of such instruction in a practical yet perhaps less efficient manner than the class I have just referred to. Then, of course, there is the third and last class . . . men and women and children who simply won't learn. Even bitter experience has no effect on this class. The will to absorb any information that will result in profitable and infinitely more healthful living conditions has, by some oversight, been omitted from their characters.

In a city made up of over seven million people, we find it necessary to cope with not one, but all three of these classes. And each class must be treated in accordance with the willingness of its constituents to learn. Therefore, the Department of Sanitation has daily to face a most discouraging problem, and that problem is *the effort to make the residents of the City of New York litter conscious;* and to force into the minds of all three classes the desire to make the city the cleanest city in the world, and in consequence thereof, the healthiest.

Getting Cooperation of the Citizens

My friends, our department undertakes the enormous job of cleaning 4,000 miles of streets every day in the year, according to the figures recently compiled, irrespective of weather conditions. I am reminded of Mark Twain's famous quip to the effect that a certain New England city boasted 144 different kinds of weather in a single day. I might add that New York is not far behind that figure and may even go it one better. But the point I wish to make is this: That up until a short time ago when the first results of our very definitely planned system of sanitary education were visible, every Tom, Dick and Harry in the city had the idea that our enormous fleet of trucks, in cooperation with our vast army of 15,000 men in

the department, was quite able to keep the city spotless. It was actually a case of "Let George Do It!" Now, it is perfectly obvious that it is a physical impossibility for this department, or any other department to perform such a miracle unless the people themselves are educated to a spirit of cooperation by some system which will not only produce the desired results but which will operate with the added advantage of making the people *want* to help to keep their city clean.

I do not say that the system we have produced is perfect by any means, but as time passes we discover our mistakes and gradually eliminate false conceptions and methods, and by experimentation substitute others we believe more effective.

Our educational program now embraces many forms of approach not only to the individual but to the masses. Up to December 31, there was assigned to our department a total of 3,827 pieces of various types of automotive equipment, and most trucks were adorned with large letters which the eye could not escape, reading "DO NOT LITTER THE STREETS"—the Department's slogan. And thousands of metal signs bearing similar advice to the pedestrian were put on streets and attached to lamp posts at intersecting street corners, reading, "Do Not Sweep Anything into the Streets"—"Curb Your Dog" "This Is Your City—Keep It Clean."

Ten thousand attractive posters showing a picture of Father Knickerbocker pointing to two children who are throwing paper into a rubbish can, saying—"We are helping—are you?" have been placed in conspicuous places scattered throughout the five boroughs of Greater New York. Such devices as signs and posters serve only as constant reminders to a mass public and the desired effect may be somewhat questionable as one of actual force in productive results. Such media are far removed from what I may call the personal element and interest.

To reach the individual resident should be the acme of this form of education, for in that fashion, and in that fashion alone, will the personal interest in civic cleanliness be aroused.

Organization for Boys and Girls

With that idea in mind, in September of 1934 we organized the Junior Inspectors' Club, an organization of boys and girls between the ages of six and eighteen, the members of which, regardless of race, creed, or color, are pledged to observe the department's slogan,

"Do Not Litter the Streets." All members receive a membership card on which is inscribed name, address, sanitation district, and section. The membership today numbers over 110,000.

Meetings are held regularly each week in convenient locations. Members are then instructed in problems of sanitation, the methods we are now using to cope with these problems, and in the procedure followed by the department in maintaining a clean and healthful city.

That all sounds pretty drab, I'll admit, and does not appear much of a lure to boys and girls of those tender ages to attract them into the Club. And it is not. But there is another side to the Club's interest in these boys and girls and to their interest in their Club. Hobby clubs have been formed, games are played, and plans for outings, hikes, trips to various mercantile and industrial establishments, and to major league baseball games and motion picture theatres, are formulated and subsequently carried out. The fact is that up to the present week we have entertained approximately 57,000 boys and girls this year on these excursions which are both educational and enjoyable.

Naturally, special stress is placed on the observation of the slogan, "Do Not Litter the Streets," and the connection is thus created between civic cleanliness and the cleanliness of the home, the school, and person. The Works Progress Administration has supplied a group of men and women, known to these children as Counselors, who have been chosen for their fitness as organizers and leaders among young boys and girls.

The total number of members, it seems to me, is all the more impressive because it pointedly demonstrates the popularity of the club among the children themselves and the desire on their part to take an active interest and participation in the work of one of the city's great departments. The fact that there are no dues or assessments greatly dispels any possible fear on the part of underprivileged members to participate in all forms of the Club's activities.

But the influence of the Club is far more deeply rooted. New York—in fact, any great city—has been, is, and apparently will be a fertile field for the breeding of one of the greatest and most poisonous scourges of modern times. I refer to juvenile delinquency. Rarely does a day pass but what our senses are startled and our feelings revolted when we read of what some boy or girl did the preceding day. A crime of some sort was committed! What to do?

Punish the boy or girl after the thing is done? Hold the poor little fellow up to shame as a shining example to our own children of what not to do?

These are problems that require the utmost consideration and the most delicate treatment of over-sensitive little folk. And for that reason, we feel that the Junior Inspectors' Club has, at least in part, wrought a solution—an answer to this grave problem that confronts mothers and fathers all over the land.

The answer is simply *to get at the tendency to do wrong at its source, and replace it with the tendency to do right.* Children are, after all, easily led. It's a case with them of "follow the leader." Once you inaugurate a good, clean, healthful activity, you'll find it an absolute impossibility to restrain a boy from participation, and as soon as his interest is assured, you'll find it equally impossible to hold back his friends, yes, even his enemies. Once teach a child that it's not the smart thing to do wrong, but it is most decidedly the smart thing to do right, and he'll almost invariably break his neck to do the right thing.

And so it will be noted that the Junior Inspectors' Club serves a double purpose. It not only makes boys and girls litter-conscious, but at the same time it absorbs their leisure time and gives them wholesome recreational, and educational and cultural activities—thus avoiding juvenile delinquency, and providing for the future a better citizenry.

Nor is this all. Three times weekly the more talented of the members of our Club are permitted to broadcast half-hour programs over the municipal radio station, WNYC. Auditions are held under competent direction prior to these broadcasts, and in this way, these little singers, dancers, and musicians are taught poise, confidence in themselves, how to apply themselves to good hard work, and the difficult art of radio technique as it is practiced in modern radio studios. Hundreds of complimentary letters from our radio audiences are received weekly and testify to the genuine enjoyment these programs generate. In this way too we request our invisible audience to cooperate by adopting our Club's slogan "Do Not Litter the Streets"—and this is repeated at least three times at each broadcast.

Then, too, there are duties assigned to a director of sanitary education—and to the head of this department is assigned the important function of making the people of the City of New York dirt-conscious. This can be accomplished only through intensive

education (not only of adults, but of children also) in the laws of sanitation. Therefore, the director of sanitary education is establishing, wherever possible, Clean City Leagues in the elementary and junior high schools and the parochial schools of this great city and also lectures on the doctrine of cleanliness.

The object of these Leagues and lectures is to develop, even though gradually, a sense of individual responsibility in the mind of the child, to insure cleanliness in his neighborhood and his school, and to arouse a sense of civic pride in the betterment of his city.

If the child can be educated to realize that clean streets are as important as clean homes for the preservation of his health and comfort, there is no doubt that a great sense of responsibility as to their city will be aroused in the younger generation, which by sheer force of public opinion will create and then insist on the observance of civic cleanliness by all citizens, young and old.

Again I stress the phrase when I say that we make the children "litter-conscious." They are taught by example to deposit their wastes in the receptacles provided (there are now approximately 45,000 litter cans and wire baskets at the street corners throughout the city), and to warn offenders whom they detect in the act of promiscuously strewing the street with litter and other debris in violation of the regulations of the department of sanitation and the law. Summer schools and playgrounds are likewise visited in the vacation period and the same doctrine of cleanliness is expounded. Cleanliness thus becomes literally a part of the modern curriculum of our school children.

In conclusion, let me say that all of this is not nearly as complicated as it sounds. What we have accomplished here in New York has been motivated by the high ideals and standards of our beloved Mayor, the Honorable F. H. La Guardia, and can be accomplished quite as fully and effectively in other communities by means of proper and self-effacing organization. However, once the set-up has been put in working order, one can't sit back and pat himself on the back and consider the work done. Such enterprises as I have tried to describe to you here this morning require constant and persistent plugging of the most ingenious sort. And above all, we find that in order to interest the child first and through him, the home, the very soul of sincerity must inspire you if your goal is to be achieved.

I feel that this report would be incomplete if I did not pay a well deserved tribute to the various boards of trade and civic organizations throughout the Greater City, as well as the Outdoor Cleanliness Association, for the invaluable aid and cooperation they have offered the department. The officials of these organizations cause a periodic survey to be made in the areas under their control, to see that the rules of the sanitary code are strictly adhered to by their members. In the case of the Outdoor Cleanliness Association, block captains are appointed, and where violations are observed a report is forwarded to our department where it receives our immediate attention.

By their profound interest in the activities of our department, these organizations have been of inestimable aid to us in our program of educating the public in the matter of street cleanliness, and the department owes them a debt of gratitude for their fine service.

DISCUSSION

H. D. Bradley

Street Commissioner, Toronto, Ont.

Mr. Napear has presented a very sound case for public education as an important factor in street sanitation. He very aptly segregates the population into three groups, viz., those who abide by departmental regulations and ordinances; secondly, those who are diffident, but willing to cooperate; and thirdly, that group of citizens who apparently have no civic pride in the interests of cleanliness.

This latter group could likewise be divided into three classes who are directly responsible for the unsightly condition of our public thoroughfares. First there is the householder who has a total disregard for the use of garbage and refuse receptacles, and persists in depositing lawn rakings and other rubbish in the gutters to the detriment of our sewer inlets. Next, the fruit and vegetable merchant, and those engaged in similar business, who continually sweep the litter from floors of their shops onto the sidewalks and roadways, plus bakers, fruit peddlers, and other door-to-door canvassers who leave an array of litter in their wake. Finally, we

have the general contractor during the process of excavation and construction, the various advertising agencies which distribute hand bills and circulars, and the transport companies from whose vehicles all sorts of litter finds its way to the roadway.

Public education of such offenders might produce minor results, but the strict enforcement of ordinances and prosecution appear to be the only solution in many cases.

Mr. Napear brings out a very timely point—particularly in view of the reduced budgets which all cities have experienced in recent years—when he points out that prior to the inception of their planned system of sanitary education everyone had the idea that regardless of the amount of litter, its source or location, it was the bounden duty of the department of sanitation to remove it. Citizens of this type are usually the first to criticize civic expenditures and the most reluctant to do their part in this great cooperative undertaking.

Mr. Napear has not indicated in any way the cost of this sanitary education, or the operating expenditure of the Junior Inspectors' Club, which has now enrolled 110,000 members, a greater membership than the population of many cities represented at this conference. This cost must be considerable but relatively small when compared with an operating budget of $29,000,000 annually. The cleaning of 4,000 miles of streets is an enormous task, but from the annual report of the department it is observed that 5,756 sweepers are regularly employed, or on a unit basis each sweeper has an average of less than three-fourths of a mile of roadway to maintain. This sweeping service is further augmented by the operation of 400 motor flushers.

In Toronto, with 600 miles of improved roadway, we feel that we are doing a splendid job with 200 sweepers, or an average of three miles per street sweeper, and the assistance of six motor flushers.

According to the Annual Report of the City of New York, for sweeping and cleaning, collection of refuse, final disposition, and snow removal, the expenditure last year amounted to over $28,000,000 for a population of 7,000,000 people, or $4 a person. In Toronto the cost of covering the same service amounts to $2.60 a person.

I have not made this comparison in an attempt to criticize, be-

cause it is apparent to all that with New York's density of population there is a greater demand for public service and a greater need for sanitary education.

GEORGE H. ELLIOTT, JR.

Acting Engineer, Bureau of Street Cleaning, Baltimore, Md.

IT WAS with pleasure that I accepted the invitation to discuss the address delivered by Mr. Napear on the very important subject "Public Education as a Function in Street Sanitation."

Civic cleanliness is not a new problem by any means, as it confronts the officials of all street cleaning departments over the country. I am quite confident that we all realize the importance of regular and frequent collections of all waste materials such as garbage, ashes, and trash, as well as the absolute necessity of the enforcement of all ordinances and laws pertaining to the storage of these materials between collections, the use of regulation sanitary containers in that storage, and the direct connection and important relationship of these functions to clean streets.

By the acceptance of the aforementioned facts we are then brought face to face with the important function of street cleaning. Street cleaning may be successful only when the citizens of a city have a reasonable amount of civic pride, and will cooperate with the department rendering this service. It has been said that the first function of street cleaning is to remove those materials which are left on our streets by the various collection services.

The dirt on our streets may be divided into two classes: First—"natural dirt," which consists of the following: refuse from the collections, soot and grime from the air, offal from overloaded equipment, manure, etc., all of which may be considered of an unavoidable nature. The second class of dirt may be termed "unnatural," and consists primarily of litter, composed of hand dodgers, discarded newspapers, torn envelopes, scraps of paper, candy wrappers, etc. This latter class is unnatural, and therefore should be, and could be, avoided. It causes the most concern among all street cleaning officials in every city of America. Who are responsible for these conditions? Thoughtless and careless people.

There are two ways to correct this situation: one, by police en-

forcement, or the investing of police powers in street cleaning officials; and the other—public education. The first-named method has not proved very successful because, if saddled with enforcement duties, the street cleaning bureau does not perform its proper function of cleaning streets, but becomes an enforcement bureau, and, also, offenders who are apprehended refuse all future cooperation—and I am quite positive you will agree that the thing most needed is the cooperation of our citizens.

What then is the best possible way to obtain this cooperation? By public education. Through what source may public education be started to make the citizens litter-conscious? Mr. Napear has given us that answer, and has explained very thoroughly the program of public education now in effect in the City of New York.

Consider for a moment the present enrollment of 110,000 children between the ages of six and eighteen as members of the Junior Inspectors' Club. These children receive instruction in sanitation problems and have pledged themselves to observe the slogan of the department of sanitation, which is "Do Not Litter the Streets."

It is not difficult to appreciate the value of just this one phase of the program. It shows that Mr. Napear firmly believes that children are the most fertile field to sow the seed of public education, for it is an undeniable fact that the children of today become our citizens of tomorrow.

What results have been obtained since the institution of this program in 1934, at which time the Junior Inspectors' Club was organized, radio broadcasts begun, the signs were posted over the city calling the attention of the citizens to littering, and the assistance of other organizations who are cooperating was received, as mentioned by Mr. Napear, are unknown at this time by me, but I am confident that these results are very satisfactory. Therefore, I certainly must approve of the work being done, and agree with Mr. Napear that public education is one of the most important functions in street sanitation.

In Baltimore public education is carried on along the following lines: Radio broadcasts, talks to various improvement and civic associations, slogans on the wastepaper containers located on the various street corners throughout the city, reading "Civic Pride Demands Clean Streets," "Form a New Habit," "Use This Container for your Trash," "Dirt is an Arch Enemy of Health," and "Filth Breeds Disease." In addition a paper has been prepared

describing the functions of the bureau in story form, and this is supplied to schoolteachers, pupils, the public library, or anyone else who is interested in the subject. During the past summer it has been my pleasure to work with a member of the Curriculum Department of the School Board in mapping out a course in civics, which embraces all of the functions of the bureau, and stresses the unsightly appearance of our streets due to litter.

In conclusion may I say that the responsibility for cleaning the streets belongs to the department of street cleaning. How long the streets remain clean after this service is rendered is certainly determined by each and every citizen, and until such time as these citizens are made litter-conscious through public education, there will be no improvement.

Motor Equipment and Maintenance in the New York Department of Sanitation

LORON G. KURTZ

Director of Motor Equipment and Maintenance, Department of Sanitation, New York, N. Y.

THE DEPARTMENT of Sanitation in the City of New York, as it goes about its daily task of cleaning the streets, collecting, removing and disposing of the waste materials, meets with every problem encountered in any large city, and, in addition, problems that are peculiarly its own.

The citizens of this great city have come to expect a type of service that would be prohibitive in most communities. Collections must be made each day in all but a few outlying areas, instead of once or twice a week. All main thoroughfares must be washed and swept at least once every day. Our 5,700 sweepers, out of the 10,000 uniformed personnel, patrol many miles of our streets and clean some of them as often as five or six times each day. When snow comes to our city then it is really "double trouble" for the poor sanitation worker.

In New York we have approximately 16,000 taxicabs, 3,500 buses, and thousands upon thousands of trucks and private cars, and on a snowy evening they all seem to be in midtown Manhattan. How the sanitation chauffeur ever gets through with a snow plow, few people know, but, like the good soldier he is, he does get through and the streets are kept open.

That you may better visualize this huge responsibility, let me quote you just a few figures:

1. There are over 4,000 miles of streets to be flushed and cleaned.

2. The *Annual Report* shows a daily collection of 107,000 cubic yards of waste material dumped from a million receptacles. This must be removed and disposed of.

3. In the winter months, snow must be plowed on 4,000 miles of streets and then removed to various points of disposition. For every inch of a snowfall, there are almost 1,000,000 cubic yards of snow to be handled, on just the mandatory streets alone.

4. Three thousand eight hundred pieces of equipment must be maintained and serviced, in order that all this work may be accomplished economically and without delay.

The year 1936 found the department, so far as automotive equipment was concerned, in a complete state of obsolescence. The new Commissioner, the Hon. William F. Carey, was faced with the responsibility for the collection of this huge amount of waste material with obsolete trucks which the men had to load by hand, lifting the cans high over their heads, working in a continual cloud of dust which is prevalent with that type of loading, and with the top man standing up to his knees in filth. These 2,000 collection trucks, with their sloppy doors and solid tires, rattled over the streets of New York, disturbing every one, and rightfully drawing condemnation from every resident.

There were some 300 power flushers, whose transmission gears howled loud enough to wake the dead, and snow loaders which were "loaders" in name only. The yearly cost of maintenance was staggering!

Through the personal efforts of His Honor, Mayor F. H. La Guardia, and our Commissioner of Sanitation, the Board of Estimate approved an appropriation of $7,000,000 to be used for the purchase of new equipment. Of this sum, $4,000,000 was to be used during

1936, and the balance of $3,000,000 (later increased to $4,500,000) was to be used during 1937.

To begin with, our equipment may be roughly divided into three major groups: (1) street cleaning and collection equipment, (2) waste disposal equipment, and (3) snow removal equipment.

The first group is composed of approximately 2,000 collection trucks and 400 power flushers. Our experience demonstrated definitely that it would be neither practical nor economical for the city to purchase stock models of collection trucks. Modern sanitation procedure made it nesessary that the method of handling waste materials should insure quietness of operation and a minimum of dust; also the unit must be constructed to give years of service with a minimum of maintenance.

Because of the extreme seriousness of the equipment situation, and the fact that winter was approaching, there was insufficient time for our engineers to give the necessary attention and study to the development of a proper vehicle, so it was decided that the first group of machines would be of the type that could be loaded by hand, with the body entirely enclosed. Department engineers designed a 44,000 pound gross vehicle, with a 24-cubic yard capacity body. All doors on the body were locked tightly against rubber, and loading sills were insulated with heavy blocks of rubber to reduce the noise of the metal containers hitting against them. The chassis frame, the under-body frame and wheel bearings were extra heavy to prevent unsteadiness and possible tip-overs when dumping on fresh land fills. It was also necessary that each piece of equipment be used for snow plowing, so it was important to devise means for quickly mounting and dismounting a snow plow. On our latest type trucks, this operation can be accomplished in less than five minutes, as against at least a half hour by the old method. This item assumes quite some importance when fighting a sudden storm, as it means that the trucks may be kept at their regular work up to the very last minute.

Realizing from the start that the oldfashioned method of loading waste materials by hand through the side doors or over the top, allowing litter to blow around the streets and into open apartment windows, was entirely unsanitary and obsolete, a careful study was made during the late months of 1936 of all existing types of automatic loaders that were available commercially, and many which

were merely ideas. None of them were entirely satisfactory, so, after exhausting that source, we set out to design one of our own, keeping in mind the idea of utility and simplicity, while using nothing except proved methods of material handling.

The first demonstrator model was built in our own shop, and, upon practical tests, showed such promise that two more bodies were ordered from a commercial body builder. These, in turn, went on regular collection work, and after two months of continuous operation we wrote specifications and purchased 300 units. A few months later, with some minor improvements, 200 more were purchased. We now have 500 mechanical loader type trucks working every day. Their operation shows approximately 25 per cent saving in labor, along with a great reduction in personal injuries such as strained ligaments and hernias caused by the heavy lift. Now, with this sanitary truck, no litter is blown about during the period of loading, and there is a minimum of dust during loading as well as during removal to the point of disposition. The body can be kept closed at all times with the exception of the opening at the rear where the material is dumped onto the conveyor. We permit no accumulation of objectionable matter, either inside or outside of the truck, as strict orders compel a thorough washing at least once every day. So far, in a year of continuous operation, no major mechanical failures have occurred, and we look forward confidently, knowing that we may expect normal maintenance throughout the life of the unit. Improvements in the loader mechanism are constantly being made, and will continue to be made as fast as new devices are found and approved, and although we do not claim the unit to be perfect, we do know that we have made a long mile of progress in the sanitary handling of waste materials here in the City of New York.

Of the 400 power flushers being used, 125 are of new design. Seventy-five were purchased in 1937 to our own drawings and specifications. Through careful study we have been able to eliminate practically all of the noise incident to the operation of a power flusher. They are of 2,500 gallon capacity, unit powered, and with a midships transmission. Power for the pump is taken off the transmission by means of a silent chain power tower. On these later units, the flusher pump is located in the beaver tail, at the rear, thus more completely insulating any possible noise. Care in the design and construction of the transmission has also contributed

toward the quietness as a whole through the use of helical gears in first and second speeds. These flushers are sufficiently quiet so that they may be operated during the night without the least disturbance to sleeping residents.

Like the collection trucks, each flusher has its own snow plow and the necessary hydraulic equipment for its operation. All controls are in the cab and within easy reach of the chauffeur.

Waste Disposal Machines

The second group of machines, that for waste disposal, is composed of a miscellaneous assortment of crawler tractors, crawler wagons, bulldozers, graders, draglines and trucks of various description and design. The waste material collected each day is disposed of by two major methods. About half goes to the incinerators, the operation of which you no doubt are thoroughly familiar with. The second half goes to land fills.

Up until January, 1937, a large percentage of all of the land-fill work was confined to Rikers Island. Material was taken to the Island by means of scows, unloaded by bucket to tip-cars and hauled to points of disposition on the Island by small steam engines. This method was expensive and terribly untidy. The department decided to purchase heavy crawler tractors and wagons, and their use, in addition to showing a yearly saving sufficient to cover their cost, has materially improved the condition of the fill. Up to the advent of the tractors, Rikers Island was infested with rats and spontaneous fires were occurring almost continuously. Since these heavy tractors and wagons have been used, rats have entirely disappeared from the Island and it has been months since a spontaneous or surface fire has broken out. We attribute this to the continual hard packing of the material by heavy tractors, the absence of voids in the fill and the decrease of extraneous fire hazard, due to the discarding of coal-fired engines. In addition, it is very much easier to maintain the contour and level according to plan.

Operation such as that at Rikers Island, because of its location and the fact that it must be reached by water, is necessarily more expensive than if the refuse were disposed of on land fills. Through intelligent approach to this problem the department has probably made the greatest step forward in the history of waste material disposal. Ordinarily, by using the greatest care possible in the selection and segregation of materials going to such a fill, the untidy

appearance, along with its accompanying odor, lasts for the full period of the operation and for months thereafter. Our present method has been developed by men in the department and has the approval of nationally recognized engineers.

The time is too short to discuss the method in detail, but I would like to call your attention to the progress pictures on display here in the convention rooms and to a detailed report in the September 1 issue of the *Engineering News-Record*. The equipment used is a heavy tractor bulldozer and a dragline with a 1½-yard bucket.

Snow Removal Equipment

The third group includes 250 snow loaders, 125 of which are of the latest type obtainable, purchased late in 1936. Usually, the snow loader does not go into service until the storm has abated and all the snow has been plowed into windrows. A group of trucks is assigned to each loader at that time and the removal of snow continues until the streets are clear.

In this same group are 631 light tractors, with crosswalk plows attached, hydraulically operated, which are used for cleaning street intersections. We find that these machines are absolutely indispensable for maintaining our street intersections in a passable condition for pedestrians. They are also used for piling snow and pushing it toward open manholes after the storm has subsided.

Normally, these tractors can be used for only a few months each year, but we have an experiment on the way whereby they may be made to serve the department in the summer months as well.

This winter the department will have approximately 100 snow brooms, 50 of which have been designed by department engineers. On this latest design, the broom has been assembled on a power grader type unit, in conjunction with a light snow plow. This is an innovation, but because of its sturdy construction we feel confident that a great deal of snow can be moved, especially from our bridges and river drives. By means of the broom the snow can be thrown completely clear of the highway or bridge, thus avoiding the necessity for carting it away.

Maintenance Problems

Necessarily, with a fleet of the size operated by the department, the maintenance problem becomes a major one. Six hundred and seventy-five men are employed in the maintenance and repair group.

One hundred and fifty of them are scattered in 56 garages throughout the five boroughs, where all daily minor repairs are taken care of, and 425 are assigned to the Central Motor Repair Shop of the department, located at 16th Street and Avenue C, Manhattan. This building consists of 10 floors with approximately 500,000 feet of floor space. The department will use all but two floors of this building, which is completely equipped to do practically all work necessary on any type of vehicle which the department owns. It has a complete machine shop, including lathes, cylinder grinders, brake repair machines, machines for repairing and adjusting hydraulic hoists and hydraulic pumps and, in fact, for the repair of all units used by the department. It includes a complete motor room for the overhauling of engines, and a test stand for running in; blacksmith shops, welding units (for both arc and gas); dynamometer and, within a few months, one entire floor will be given over to a modern paint shop.

Every effort is put forth to keep our equipment looking clean and sanitary, and present plans call for at least one coat of fresh paint every six months on those units which are in daily use. There is a battery charging and repair room where we are equipped to completely overhaul a battery or to construct a new one. We cast our own terminal posts, strap connections, and nuts in dies made in the machine shop. Service records show that our batteries have materially longer life than the average commercial unit. There is also a complete electrical test and repair room, where new accessories may be tested for comparative efficiency and repair work done on nearly every electrical device found on a modern vehicle.

All of this equipment, of course, is for use at the time when major repairs are forced upon us, but our maximum thought and effort is concentrated in trying to postpone this expense of major repair just as long as possible. Our methods are simple in the extreme, but they are none the less important. I shall place them in three groups:

1. Preventive maintenance
2. Training of the operator so that he may become familiar with, and get the feel of, each special unit
3. Instruction of the Division of Safety

Preventive maintenance is fundamentally sound, and insures regularity, uniformity, and thoroughness in its application to a single vehicle or to the huge fleet such as is operated by our depart-

ment. We have 1,075 new heavy duty trucks on schedule for this service every month. The unit is taken out of service for one day and driven to the Central Motor Repair Shop by the regular chauffeur. His work during the day is that of cleaning and wiping the engine and chassis, and then lubricating the entire unit, under the supervision, of course, of the attending mechanic. For this work, modern power grease guns are used. The very best men available are assigned for the general service work, and have long since become expert. There is an average of 43 points of inspection that this mechanic is responsible for, which include such items as checking with a motor tuner; cleaning and adjusting spark plugs; adjusting valves; checking generator for charging rate; examining starter; checking and filling the battery with water; inspecting and adjusting belts for the fan, water pump, and air compressor; checking and cleaning the water circulating system; checking and correcting, when necessary, the front wheel alignment; equalizing the brakes; checking tire inflation and any damage which may cause blowouts; watching tire replacement to see that tires are properly matched for wear; and dozens of other points which, if properly corrected, will help to insure continual operation. When major repairs are necessary on a transmission, engine, or double reduction drive, it is immediately replaced by the unit repair system and the truck put back to work with the least possible delay.

The department operates a regular School of Instruction, which is under the supervision of trained men, and where small groups of operators are brought according to a definite program and given careful instruction and experience in the handling of our new pieces of equipment. It is only after passing a satisfactory test, under the supervision of these trained men, that a chauffeur can be assigned to a vehicle. The department spends considerable effort on this project, and is well repaid in the lessening of accidents and damage to the various units.

To illustrate further, during the early fall of 1937 the department shipped 10 snow loaders to Lake Placid for operator training. Ten groups of 30 men each were then sent there at the department's expense and given several days' work with these loaders, under actual snow conditions. We knew we would be amply repaid for our trouble through the much greater efficiency of the men during a storm here in the city.

Last but not least we must consider the work of the Division of

Safety. Under the direction of an expert safety engineer, that division is continually on the alert to assist the department in setting up rules and regulations for the safe operation of vehicles on our streets. Their constant policing of equipment and immediate checkup of all accidents is responsible, to a great extent, for our excellent safety record.

The New York Department of Sanitation is doing a big job every day in a quiet, orderly manner. That, after all, is just good organization under the direction of a sympathetic and understanding management.

DISCUSSION

Frank Rowe

Supervisor of Motor Vehicle Equipment, Rochester, N. Y.

Mr. Kurtz has presented a brief summary of a portion of the work of the Department of Sanitation of the City of New York. To you who are concerned with the maintenance of municipal motor equipment, I urge that you observe first-hand the work being done and the equipment now in use in the department here.

Rochester is indebted to New York for the specifications which enabled it to purchase several modern auto-flushers, and these are doing excellent work, not only in flushing pavements but in snow-plowing work as well.

Mr. Kurtz mentions the subject of preventive maintenance. To my mind this is the most important factor in the operation of municipal motor equipment. Probably few cities have the funds and facilities to carry on the work as it is being done at the present time by the Department here, but Rochester has endeavored to achieve in part the same results.

In Rochester, the Division of Maintenance and Operation operates three garages at which motor equipment is stored and serviced, the number of units being about 460.

Preventive maintenance begins when the sub-division of Motor Equipment supplies to the Division of Purchase the specifications under which the various kinds of equipment are purchased. Competitive bidding is required but this does not mean that the specifications must be wide open. The endeavor is to obtain the best type of equipment to fit the job, and this point, as Mr. Kurtz has indicated,

is most important, if operating costs are to be kept at a minimum. Thereafter the results are in the hands of the operating personnel under the direction of the Supervisor of Motor Equipment, and when the equipment is purchased and placed in service efforts are directed to give it the best possible care.

To date, the division does not have a training school nor a division of safety. However, monthly conferences are held with representatives of the insurance carriers at which meetings the Director and the Supervisor of Motor Equipment represent the city. The accident reports over a 30-day period are discussed individually and the driver concerned may be requested to attend the next meeting. This procedure seems to be working out well. Incidentally, for each month in the year during which a driver does not have a preventable accident, he is granted one-half day of vacation with pay. It is obvious that the majority of drivers will put forth some effort to prevent accidents.

William A. Xanten

Supervisor, City Refuse, Washington, D. C.

After hearing Mr. Kurtz give New York's equipment figures, I am constrained to admit that Washington, figuratively speaking, is finally put in its proper place. It is an impressive task that they have to do in this work of refuse collection and disposal, street cleaning, and snow removal, and it is evident, as in all cities, that the question of equipment design and maintenance is one which requires the most careful study and attention. I am sure that each of us charged with this responsibility realizes that to a large extent the design or type of equipment used in these services is a matter which must be definitely related to our own particular problems.

In the City of Washington there are some 260 pieces of equipment, including trucks, flushers, tractors, passenger cars, and two snow loaders. As 90 per cent of all collections are made from alleys, the question of design is restricted to short wheelbase trucks, with no space available for the inclusion of mechanical loading devices. Our purpose has been to keep the loading height as low as possible, while at the same time getting the largest body on the chassis consistent with the class of refuse to be handled and with easy negotiation of the alleys.

On the other hand, the storage, maintenance, and repair of motor equipment is a job that we all have in common, and the efficiency with which this maintenance operation is carried on is a vital factor in the ultimate efficiency of the service rendered.

In Washington, we have, I believe, a set-up with respect to equipment maintenance that is similar to that for New York, as described by Mr. Kurtz. That is, the division in charge of the work of refuse collection and disposal, street cleaning, and snow removal, has direct and complete jurisdiction over the design and maintenance of all equipment used in this work. We believe this is desirable, particularly in that it enhances our ability to coordinate the repair and assignment of equipment at all times. This independent set-up likewise permits separate storage garages which are located strategically with respect to this work—an important element in getting on the job quickly and without confusion each day. All major repair work is handled at the division's central garage.

Mr. Kurtz calls attention to the effectiveness of preventive maintenance, and to its principal objective of postponing major repairs as long as possible by keeping a truck fleet properly checked and serviced. Another point in this connection that more than ever justifies exceptionally high standards of maintenance is the fact that breakdowns on the job are very costly in work of this nature, where, by the absence or delay of equipment, the work of a labor crew is usually paralyzed completely.

In Washington all equipment is operated by civil service employees. The drivers are called upon to report daily on their time cards any minor or major mechanical defect, and they are required to bring their equipment in periodically for checking and servicing.

Accurate cost-keeping records are kept and these data are used to advantage in various ways. For instance, lists of part replacements are compiled to discover recurring mechanical failures, which are corrected, if possible, by strengthening future specifications in this regard.

As usual, daily gas and oil consumption for each unit is recorded. However, the cost accountant is required to keep close check of this daily consumption and excessive or abnormal usage by any one truck results in an immediate request for explanation or correction by the mechanic in charge.

The large majority of the trucks on this work in Washington were purchased during motorization of the services from 1929 to

1932. The fact that these trucks are doing a pretty swell job today can be attributed to our strict adherence since that time to the policy of what Mr. Kurtz calls "Preventive Maintenance."

I cannot help but feel that perhaps the progress made in New York in securing modern equipment for these very essential services —and more important, the ability of the Department of Sanitation to obtain recognition of their equipment needs—will have a stimulating influence throughout the country in this field. If so, I am sure some of us will owe this great city a debt of gratitude.

GENERAL DISCUSSION

Chairman Bradley: Thank you, Mr. Xanten. Are there any questions on this portion of our program?

Mr. Frederick T. Paul (Minneapolis, Minn.): Would you mind giving us some idea of the inter-departmental rent per hour on some of the equipment?

Mr. Kurtz: Do you mean how much we pay to the chauffeur?

Mr. Paul: No. Do you rent your equipment to other departments and do you carry it on a rate basis?

Mr. Kurtz: The Department of Sanitation uses its own equipment. We have had no reason to set up any rate structure. The only time the equipment is used in another department is the possibility of borrowing trucks equipped with snow plows to help plow the snow.

Incidentally, the personnel is one hundred per cent civil service. They have their own organization of drivers and sweepers which is represented by their own members. Possibly some of the men belong to unions, but we do not pay any attention to that at any time. Among the mechanics, I think a big majority of them belong to the A. F. of L.

Speaking of preventive maintenance, each one of the speakers following me mentioned it and I think you will agree that it is a good thing. Here is a city where we are practicing preventive maintenance in the mechanical division, but that is only one division. I would like to say that you will not have a true preventive maintenance unless you have instilled into the minds of your chauffeurs and operators that their work is just as important as and, in fact, more important than the work you do in your shop. That is the object of our training school.

Round Table on Snow Removal

EDWIN A. MILLER
Supervisor of Maintenance, Rochester, N. Y.

I HAVE recently read with interest Chapter VIII of *Street Cleaning Practice,* which, as you may know, pertains to snow removal and the treatment of icy pavements. I will endeavor to enumerate the points which I believe have the most importance in snow fighting, especially those which have made snow plowing and snow removal successful in Rochester, New York.

Don't wait until snow has fallen before you start to plow. Traffic will defeat you every time.

Form an acquaintance with your local meteorologist. He will give you all the information you want as to the relative position of snowstorms. After some practice you should be able to determine this question for yourself by reading the daily weather map.

Better yet, if there is an airport in your vicinity which has a United States Weather Bureau Station, check back with the meteorologist at this point. He receives hourly reports, and will gladly inform you of the near approach of snowstorms. This will enable you to have your plows hooked up and your truck drivers ready. As soon as the snow reaches a plowing depth you can begin the battle.

Don't try to fight snow without a good organization. Rochester has one of the best organizations in existence. Every man in the Maintenance Section has his winter duties as well as his summer duties, and when the snow season arrives he knows just what he is expected to do. Have a definite plan and follow your schedule. As a matter of fact we have a man working on snow plowing routes twelve months in the year, and it is his business to reduce, if possible, the plowing time of the previous season.

Don't buy snow fighting equipment because it sells at a low price. The best is none too good during a heavy storm. Make a study of what other cities are using successfully. Standardize, if possible, because that procedure will reduce your stock of extra parts. Remember, poor equipment will only crumple up during the first heavy storm which you experience.

Good equipment deserves good care. For example, our snow loaders are housed in a separate garage which is properly heated.

As early as September 1 these loaders are carefully inspected and new parts are supplied where needed. Upon their return to the garage after one shift on snow work they are washed and greased and made ready for the next assignment. Some of the loaders are over ten years old and are still doing good work. Proper attention is also given to all city-owned trucks and plows.

Don't overlook the value of rendering special services. They mean much to those to whom such services are given. For instance, during the winter months a list is made every morning of all deaths which have occurred in Rochester, as noted in the newspapers. A truck and men are sent to each home where a death has occurred and the snow is removed from the pavement in front of the residence. The walks, also, are cleaned; even the walk leading to the main entrance. After each storm snow is removed from the street in front of all Roman Catholic churches in the city. We assume that these churches have funerals every day. All synagogues are given similar service on Friday, and other denominational churches on Saturday. Special attention is given to Christian Science churches because of their large attendance at Wednesday night services. We even go so far as to look out for the interest of the expectant mother when special requests are received and where the person concerned lives on a dirt street in a remote part of the city.

Endeavor to obtain the cooperation of the public while you are fighting snow. The daily newspapers will gladly give you special space when you wish to appeal to the public to keep autos off the street while you are fighting snow. The news broadcasts will always supply you a few words over the radio if you request it. At all times try to show the public that you need their help.

In the treatment of icy pavements do not use an abrasive without adding a chemical. The chemical makes your abrasive more effective because of its melting properties, and it also keeps it in the street rather than in the gutters. Rochester uses salt because it works quickly and lasts longer.

We have a separate organization which performs the work of controlling icy pavements. There are two stations, one on the west side and the other on the east side of the city. Fortunately, the east side station is located where the most grades exist. Each station has three dispatchers who work eight hours each, and the city has three inspectors who cover the city in eight-hour tricks. Routes which can be covered within four hours have been made up in advance,

with the most important traffic points being given first consideration. As soon as the pavements begin to glaze, trucks are called to the stations and loaded with cinders and salt. As these trucks start out on their route their departure time is stamped on a time card, and when their route is covered and they return to the station, the card is again stamped. In this way we know that a truck is working full time on its route as we have the distance quite accurately figured. At all times of the day and night there are trucks available for immediate dispatch at both stations. We also maintain a storage bin in the central business section so that when a truck is emptied of material in an important part of the city it can be refilled in a very short space of time.

It may be of interest to you to know that Rochester is located in the County of Monroe, which has seventeen townships. In each township there is a Town Superintendent of Highways. These Superintendents supervise the plowing of all roads in their towns. It is arranged between them and myself that the local Automobile Club will be advised of the approach of a snowstorm, and it in turn will notify each Superintendent, regardless of the hour of day or night. In this way the township plows begin work about the same time as the city plows, and, in consequence, traffic may pass along the roads of the county without difficulty or delay.

John S. Flockhart

Principal Assistant Engineer, Newark, N. J.

Each public works official charged with the removal of snow in his own community has undoubtedly had sufficient experience with this particular problem to know that it may be one of the most trying and difficult tasks he is called upon to encounter in the course of his municipal career. Although the topic assigned for the discussion is "Snow Removal Experiences," I think that instead of relating some experience paralleling that of many officials, a brief summary of many encounters with snow removal may prove of interest.

Weather is accountable to no one, as we here along the Atlantic seaboard have found out recently. Perhaps because of this and because of its effect on man and man-made works, weather is one of the most common topics of conversation in our everyday life. To

those who are responsible for combating the results of a heavy snowfall at subfreezing temperatures, daily weather reports are of more than passing interest, and the wise official has made his liaison with every possible authoritative weather agency before the winter months arrive. A careful study of the daily weather maps during the snow period will assist him greatly and he will not be caught entirely unprepared. In other words, the state of the weather determines the probabilities of snowfall, the magnitude of the work he will be called upon to perform, and the possible assistance he may receive from rising temperatures and other conditions.

Any preparations made for snow removal might be placed in the "preventive street cleaning" class, with the thought that in fighting the storm with expensive equipment and labor, much time and money can be saved by careful planning of the extent of the removal (which will be dictated by the demand and by the funds made available).

The best selection of available personnel must be made; equipment must be checked to make sure that it is capable of continuous performance at its rated capacity; sufficient stocks of emergency tools and materials must be on hand; and the multitude of foreseen details must be provided for. Snow removal work during heavy snow is usually an emergency task because it requires the sudden expansion of the normal street cleaning organization by the addition of equipment that is not usually in service and by personnel (especially in the labor class) with no experience in the work.

Our experience has taught us that during the periods of snow there are numerous demands for prompt and complete removal in many sections of the community which have apparently overnight developed into areas of considerable importance requiring the most urgent attention. As the amount of removal to be accomplished will, in a large degree, be determined by the funds available, the planning of primary operations is confined to those areas where, in the past, real need has been shown, with the possible extension of the program to the secondary areas if additional funds are provided. It is quite impossible, of course, to estimate in advance what the snow bill will be and hence no estimate can be made beforehand, but an appropriation sufficient to cover the normal expenditures for preparation and maintenance of equipment should be made in the budget. Usually an estimate of amount of work to be done and of the cost can be made when the force actually starts its work.

In such an emergency, the official should have considerable latitude in his decisions. The general plan to be followed should be considered very carefully beforehand and each person carefully schooled in the part he is to play. While the plan should generally be followed in its essence, there are many circumstances which will arise when there must be quick decision and action. Hence the official must have the freedom to act in cases where his actions would not conflict with the general policy of the governing body.

In planning of the organization for snow fighting the selection of men for key positions is of utmost importance. Men who are trustworthy and who possess some amount of initiative and leadership are chosen and instructed in the procedure to be followed in the event of snow. These men are usually in some responsible position outside of the removal agency and their emergency assignments are made in accordance with their capabilities and adaptabilities. Probably one of the most difficult tasks is the demarcation of the channels through which authority is exercised. It has been found that the cooperation of all concerned in this respect can be secured by holding informal meetings and determining the objects to be attained by each, with due regard to the other.

The smooth functioning of the organization in action will depend in a large measure upon the numerous details. When such items as synchronization of labor and equipment, definite knowledge of location of certain equipment, adequate and complete supplies of small tools, and ample communication facilities have been provided for, there is little reason for any friction in the actual work.

As is true of any victory in battle, the use of a proper plan with a clear estimate of the situation, adequate and well trained forces which will hit hard and fast, and the assurance that supply and communication details are functioning, will enable the official to successfully combat this emergency when he meets it.

Robert L. Anderson

Superintendent of Public Works, Winnetka, Ill.

I come before you representing a rather small town. Winnetka has a population of 13,000 and after sitting here this morning and listening to descriptions of some of New York's snow removal equipment, the numbers of which ran into astronomical figures,

same kind of snow that they have and our problem is the same on a smaller scale.

As Mr. Flockhart has said, the proper equipment, well trained personnel, and good planning will fix it so you can lick almost any weather conditions that arise. In our case we have a village composed pretty largely of commuters from Chicago, professional and business men of what might be considered the more wealthy class, and they certainly demand service, but, they are willing to pay for it. We have about 45 miles of streets to handle and some 70 miles of sidewalks. As an example of the kind of service we are required to give, it is a matter of some pride to us that no school child or commuter had to go to school or to the train at any time in snowy weather where he could not safely and comfortably go in his regular street oxfords. That means that with any kind of a snow which amounts to more than two inches we must get out and plow the walks and have them all clear before eight o'clock in the morning. We have arrangements with the police department to notify all the men and get them on the job, and we can completely plow all walks in town in four hours.

When it comes to the matter of ice control—and in our climate we are subject to frequent cases when the entire surface of the ground is covered with a glazed ice—it is necessary to sand all of the walks. I don't know of any other place where an attempt is made to put sand on 70 miles of walk in a town of our size, but we do it. I am working on some equipment now that will speed that up as it is quite a job when you tackle it by hand.

In regard to snow removal in the business district, whenever there is sufficient snow to make it worth while, we rent equipment and remove the snow. We do not feel that the village is large enough to warrant the expenditure for a piece of equipment which cannot be used for much of anything else. I think that is probably the usual situation in a town of our size.

In connection with cindering and sanding, we have routes all laid out for this work. The men are called out in an emergency whenever it is necessary, and we can handle all danger points within a minimum of time. We have a good supply of cinders at our municipal plant and we use them almost exclusively, usually with calcium chloride.

We have a fleet of sidewalk tractors of the caterpillar type with power-operated plows. We have found that while a caterpillar

tractor does not travel as fast as a wheel tractor, it travels as fast as can be safely handled on our type of streets where there is a large amount of overhanging shrubbery, and the walks are winding. They travel between three and three and one-half miles an hour.

The equipment of street plowing is the usual truck equipment with truck-mounted plows supplemented by a heavy tractor for breaking open any places where the plows may be unable to keep up with things.

The cinders are spread from a regular street department truck. Three or four years ago we wanted a spreader of the type now quite common on the market but we could not find one. So we built one in our own shop and since then almost the duplicate piece of equipment is on sale by a number of different firms. Our tractor fleet was finally completed in 1935 when we bought the last two pieces of equipment. We had no snow until Christmas morning of that year and I had an experience on that day that has acted as a sort of an object lesson for the boys ever since. We put two of the plows into service for the first time that morning. It was quite cold and there was a driving snow pretty well obscuring the vision. I was at home playing around on the living room floor with the kids when I received a call from the police department to come right up as there was a train accident. I did not know what kind it was, but I hurried up there and it was the sorriest sight I ever saw. Here was one of our brand new tractors underneath the train. It seems the driver had plowed a walk up to the station and went to turn around on the station platform and slipped sidewise with one track between the rail and the edge of the platform. He could not climb back up and so he started to run to the nearest street intersection a few hundred feet away. However, before he got there a flyer came along. It was flagged down and almost stopped by the crossing watchman, but had sufficient momentum to carry our tractor down the track about 150 feet, and it wound up with the piston rod of the locomotive resting on the left side of our tractor.

We got out our wrecking car and pulled it loose and it was in a horrible condition. Fortunately it did not do any damage to the train. Well, we picked up all of the spare parts we could find, including a cast iron cover which we could not account for, but we finally ascertained that it was a cover from the locomotive. That I hung up in our garage and it still hangs there as an object lesson to tractor drivers when they get near a train.

Arthur Boniface
Village Engineer and Manager, Scarsdale, N. Y.

About two weeks ago there came to hand the manual *Street Cleaning Practice,* published by this Association, and this opportunity is taken to pay tribute to the members of the Committee on Street Cleaning responsible for the matter contained therein. That portion of the manual devoted to snow removal and the treatment of icy pavements is a veritable textbook and of value to everyone who must share the responsibility of keeping highways open and safe during winter months.

After realizing the comprehensive character of the Committee's work and its excellent manner of presentation, it seemed that the entire field of the snow removal problem had been covered and that the most useful thing to do for this round-table discussion was to submit to you the actual methods followed in a municipality of 13,000 population for meeting the snow and ice problem.

Under the care of the road commissioner in this municipality are 80 miles of highways, many of which are on steep grades. Heavy falls of snow are not of common occurrence but at times the ice problem is a serious one.

Plans for tackling this winter problem are made early in the fall. The area of 6⅓ square miles is divided into eight sections, and one truck is assigned to each section. Bids are obtained from private concerns for the immediate use when required, day or night, of trucks available for such work. The contractors whose trucks are selected agree to equip their trucks with plow frames and to keep them so equipped until the season is over. At the yard, plow blades owned by the municipality are set out, so that all that is necessary to get rolling is for the trucks to drive in, hook up, and proceed to the section to which they are assigned.

Following the selection of the trucks in the fall, the contractors agree to drive over the roads within the areas assigned so that they may familiarize themselves with the highways detailed to their care.

In addition to the driver, two men from the street cleaning department accompany each truck, one to operate the blade, the other to assist. The snow is plowed to the sides of the road and left until it melts, except in the business districts and at street intersections where it is plowed into piles and later loaded into trucks and disposed of on land dumps.

Following the completion of plowing operations, crews proceed to clear all catch basins and drainage areas to facilitate the passage of water when a thaw sets in.

On the bulletin board at the highway department's yard are displayed the snow removal assignments. Each section and the truck assigned thereto bear the same number, with the personnel set forth for the manning of individual trucks and other equipment.

All sidewalks on main highways are plowed by the highway department with their own equipment.

To cope with icy conditions of highways, boxes filled with sand and a percentage of calcium chloride or salt, together with a shovel, are placed at all hilly locations early in the fall, to serve as supplementary equipment for the use of department employees, the police, or private citizens, should any difficulty arise. On slippery mornings the highway department's own trucks are sent out at 5:00 A.M. to sand all hills, sidewalks, and main highways, and also the approaches to traffic lights.

Along highways subject to drifts, snow fences of the picket type are placed in the late fall, as these have effectively met the hazards likely to be caused during heavy snowfalls.

It is important when winter is over to inspect thoroughly and repair every piece of snow removal equipment, give it a coat of good paint, and store it in some suitable place. Such a policy will pay dividends.

The extent and character of snow removal operations are usually governed by public demand, consistent with economy, but if the job is done well little criticism is voiced of the amount expended.

What citizens seem to expect today of their local governments is that their everyday ordinary routine of life shall go on uninterruptedly. They particularly want to have the confidence, that "Neither Snow nor Sleet shall Dismay the Highway Department" and that the usual pursuits of the day may be followed. Thus a real responsibility is placed upon those whose duty it is to fight snowstorms. It can be met—and when it is, appreciation is always there even if it is not given expression.

Part Three

BUSINESS PROCEEDINGS OF AMERICAN PUBLIC WORKS ASSOCIATION

Meeting of Executive Committee

New York, N. Y. *May 21-22, 1938*

THE Executive Committee of the American Public Works Association met on Saturday, May 21, 1938, at the Hotel Pennsylvania in New York City. Guy Brown, 1st Vice-President, called the meeting to order at 11:10 A.M. The chairman of each of the divisions of the Association also had been asked to attend this meeting. Those present were Thomas Buckley, J. S. Flockhart, R. L. Phillips, H. D. Bradley, L. G. Lenhardt, F. W. Herring, and N. Hebden. President Root arrived in the late afternoon on May 21 and presided over the meeting from that point.

Occupancy of New Building

The executive director reported that on April 20, 1938, staff headquarters had been moved into the new building at 1313 East 60th Street. He described the office layout, the public space that is available for small group meetings, and the other facilities which have been provided.

Distribution of Yearbook

The executive director submitted figures on the complete distribution to date of the 1938 Yearbook. It was brought out that only about two hundred copies remained on hand, which would be needed as a reserve for members now in arrears, new members, and other purchasers. In this connection, correspondence with Robert Brooks, who had requested that about thirty complimentary copies be sent to various European engineers, was read and discussed. In view of the limited number of copies available, a motion was passed that the Association send complimentary copies of the 1938 Yearbook to the officers of the Institute of Public Cleansing only.

Status of Standard Contract Forms

Correspondence with W. W. Horner relative to revision of the "standard contract form" was presented. The Executive Committee agreed, in view of the other research work which is already under

way, that this project be deferred until the present undertakings have been completed.

In regard to cooperation with the Associated General Contractors on this project, the consensus was that such cooperation was desirable but not to the point of sacrificing any phases of such documents essential from the standpoint of public agencies.

Research Program

The status of the research program being carried on by the Association was reported by the executive director. After some deliberation, a motion was passed that the street cleaning manual, the sewer rental study, and the refuse collection and disposal manual be carried on and completed, in that order.

Discussion was given to the question of holding a meeting of the Street Cleaning Committee at which time final approval would be given the manual. It was agreed that available research funds be used to defray the expenses of the meeting of this committee, to be held about June 15.

It was also moved and carried that the street cleaning manual be published as approved by the Committee on Street Cleaning.

Membership Badge

At the request of Thomas Battin of the Philadelphia Chapter, the question of the Association's adopting an official membership badge was considered. The Executive Committee was of the opinion that a badge would probably be worth while, particularly from the viewpoint of the younger members. Mr. Battin's suggestion of a contest among the members for the design of such a badge was disapproved. The executive director was instructed to negotiate with a jeweler for suggested badge designs and possible sale arrangements, and to report back to the Executive Committee at its next meeting.

Selection of Convention Headquarters

Four hotels, the New Yorker, the Pennsylvania, the Roosevelt, and the Commodore, were given consideration as possible headquarters for the 1938 Public Works Congress and the facilities of each were analyzed. The selection of the convention hotel was influenced to a large extent by the needs of the commercial exhibits. Edgar Buttenheim came into the meeting and presented his view from the exhibitors' standpoint. After much discussion it was

moved and carried that the Hotel Pennsylvania be designated as convention headquarters.

In connection with the exhibits it was agreed that an exhibit committee be appointed and that a special letterhead carrying the name of the members of this committee be used in the promotion of exhibit space sale. The Board of Directors of the Association was designated as the Exhibit Committee.

E. J. McGrew, Deputy Commissioner of Public Works of New York City, sat in on this discussion, and the one following on the convention program, and presented his views and suggestions which were of great value to the Executive Committee.

Convention Program

The last item for consideration was the program for the convention and a lengthy general discussion ensued. A motion was passed approving a skeleton outline of the program (scheme A) as the basic pattern for the convention program, with the following changes: 1. To move forward the opening time from 9:30 to 10:00 o'clock on Monday morning. 2. Instead of the symposium on Monday morning, to have one paper on New York's public works activities to be presented by General Markham, Commissioner of Public Works of that city. 3. The sessions on Monday afternoon, Tuesday morning, and Wednesday morning to be devoted to topics on operation, design and construction, and administration, respectively. 4. To have only one scheduled luncheon, that on Monday.

It was suggested that the speakers be requested to have their papers mimeographed. Also that papers be submitted to staff headquarters in sufficient time prior to the congress to allow for timing.

It was also agreed that thirty-minute papers should be limited to one per session, other papers to be of fifteen-minute length.

Several possibilities for inspection trips were outlined by Mr. McGrew which the Executive Committee agreed were very satisfactory. Mr. Buckley suggested that a skeleton map of each trip be provided the delegates to enable them to follow their movements. Mr. McGrew also proposed to try to make arrangements to have dinner on Monday evening at the World's Fair grounds.

It was suggested that if possible either Mayor La Guardia or Robert Moses be prevailed upon to be the banquet speaker.

The meeting adjourned at 5:45 P.M. to be resumed on Sunday, May 22, at 10:00 A.M.

President Root called the meeting to order at 10:30 A.M., Sunday, May 22.

The executive director submitted a list of suggested program topics for consideration by the Executive Committee, and a lengthy discussion followed. It was agreed that the panel discussion at 2:00 P.M. on Wednesday should be on the subject, "Traffic, Safety, Parking, and Parking Meters." Roy Phillips was selected to lead this discussion.

Other topics which were agreed upon as being worthy of inclusion in the program were: public education in street sanitation; W.P.A.; street repairs, maintenance, and resurfacing; and sewerage problems resulting from technological advances, including garbage grinding, air conditioning, and industrial wastes.

It was finally agreed that the executive director should work up the program topics with President Root and the chairmen of the divisions.

The meeting adjourned at 3:15 P.M.

Meeting of Board of Directors

New York, N. Y. *October 2, 1938*

THE Board of Directors of the American Public Works Association met on Sunday, October 2, 1938, at the Hotel Pennsylvania in New York City. President Root called the meeting to order at 7:15 P.M. Those present were Guy Brown, John S. Flockhart, Roy L. Phillips, Thomas Buckley, L. G. Lenhardt, Lester W. Herzog, Henry L. Howe, Fred T. Paul, Walter E. Rosengarten, George Gascoigne, E. J. McGrew, Jr., Frank W. Herring and Norman Hebden.

A motion was passed approving the minutes of the Board of Directors meeting held in Atlanta in October, 1937, as published in the 1938 Yearbook.

The minutes of the Executive Committee meetings held in December, 1937, and May, 1938, were also approved.

Treasurer's Report

The annual report of the Treasurer was presented by Roy L. Phillips.

President Root appointed L. G. Lenhardt and Thomas Buckley as a committee to audit the Treasurer's report, instructing them to report back at the annual business meeting of the convention on Tuesday morning.

Convention Arrangements

E. J. McGrew, Jr., chairman of the Local Arrangements Committee, explained in detail all arrangements concerning the convention. After this complete discussion, the Board congratulated and thanked Mr. McGrew for the excellent job he had done.

Report on Vote on Directors' Travel Proposal

The executive director reported on the status of the vote which had been taken by letter ballot, and which had carried, on paying the traveling expenses to this meeting of those members of the Board whose expenses were not paid by their cities.

A motion was passed approving the use of the sum of $400 for Board travel expense to this meeting and instructing the executive director to expend whatever amount was necessary within this sum.

In a discussion of this question, some fear was expressed of establishing a precedent as to future policy in this matter.

Association Badge

Following the instructions of the Executive Committee given at its May meeting, the executive director submitted designs of Association pins, which were examined by the Board members. A motion was passed placing the selection of the design in the hands of the new Executive Committee with full power to act.

Nominating and Special Committees

President Root asked for suggestions from the Board as to names for the Nominating Committee.

A committee comprising Guy Brown, chairman, Roy L. Phillips and Henry L. Howe was appointed by President Root to suggest names for honorary members, to investigate their qualifications, and to announce their names before the business meeting of the Association for vote.

It was moved and passed that the executive director be instructed

to present a certificate of honorary membership to anyone elected to such membership.

Report of Executive Director

The executive director presented and read his annual report which was approved as read.

A motion was passed to the effect that the Board of Directors has taken cognizance of the book *Street Cleaning Practice* and expresses its appreciation and thanks to the committee, its chairman, and the research director.

The Board passed a motion expressing its approval of the expenditure of funds for research, instructing the executive director to attempt to seek further funds at the proper time, and recommending that the newly elected Board continue this policy.

Reports of Chapters

Reports were received from the St. Louis, New Orleans, Philadelphia, Rochester, and Michigan Chapters of the Association. The Board accepted these reports and directed that they be published in the Proceedings.

The meeting adjourned at 9:55 P.M.

Report of Executive Director

This report covers the period September 1, 1937 to August 31, 1938, and with the exception of the appended financial statement the statistical data reported are for those twelve months. As our financial records are maintained on the basis of a calendar year, and as the financial report for the calendar year 1937 has already been submitted, the financial statement accompanying this report covers only the first eight months of 1938.

Corporation Business

On February 18, 1938, application was made to the Commissioner of Internal Revenue, United States Treasury Department, for exemption from federal income taxation. In March a ruling was received granting the Association exemption under the provisions

of Section 101 (7) of the Revenue Act of 1936. This section establishes exemption for "business leagues, chambers of commerce, real estate boards" and so on. It is planned to appeal this ruling so that the Association might be granted exemption under Section 101 (6) which provides for the exemption of scientific and educational organizations, for the reason that exemption under this latter section would carry with it exemption also from social security tax payments.

The annual report of the corporation for the year 1937 was submitted to the Secretary of State of Illinois in February of this year.

The firm of Haskins and Sells, certified public accountants, completed an audit of the Association's accounts in March and copies of their report were submitted to the President and Treasurer of the Association and to the Executive of the Spelman Fund.

A complete report of the activities of the Association for the year ending December 31, 1937, was prepared upon the request of Guy Moffett, Executive of the Spelman Fund, and submitted to him in March. Copies of this report were also made available to the Board of Directors.

New Quarters

On April 20 the headquarters of the Association was moved to the new building erected on the University of Chicago campus for the organizations of public officials formerly occupying quarters at 850 East 58th Street. The Association occupies a small suite of four rooms on the second floor. The new building was designed expressly for these organizations and provides generous library space, a large conference room, a board of directors' room, and a small committee room. The building is also completely air-conditioned.

Meetings of Executive Committee

Two meetings of the Executive Committee were held during the year under report, one on December 11, 1937, in Chicago, and one on May 22, in New York City. The principal items engaging the attention of the Committee at the December meeting were the selection of New York City for the 1938 Public Works Congress and the adoption of the operating budget for the calendar year 1938. At the New York meeting in May the Committee devoted its attention largely to the program for the annual conference.

Current Membership Status

On August 31, 1938, the total enrolled membership of the Association was 764, which included 597 members fully paid up in dues and 167 members in arrears. On September 1, 60 of these delinquent members, who were in arrears for two years, were removed from the roll, in accordance with the provisions of Article IX of the constitution.

Changes in Membership

September 1, 1937 to August 31, 1938

Total Membership September 1, 1937	812
Resignations	34
Deaths	7
Dropped for nonpayment of dues	53
New Members	45
Reinstatements	1
Net Loss	48
Total Membership September 1, 1938	764

Analysis of Paid-up Membership

August 31, 1938

Paid to:	
September 1, 1939	11
March 1, 1939	84
September 1, 1938	469
Senior, Life and Honorary	33
TOTAL	597

Analysis of Delinquent Membership

August 31, 1938

Paid to:	
March 1, 1938	13
September 1, 1937	85
March 1, 1937	5
September 1, 1936	64
TOTAL	167

The membership figure of 764 is to be compared to a figure of 812 on the same date last year, a net decrease of 48. There were 45 new members elected, 34 resignations accepted, 7 deaths reported, and 53 members dropped for nonpayment of dues. The decrease of 48

members is to be compared with a net increase of 28 members during the year ended August 31, 1937. One of the major factors to be taken into consideration in making this comparison with the previous year is the establishment of the Rochester Chapter in September, 1936, accounting for 38 of the 114 new members reported last year.

Classification of Membership

August 31, 1938

City Engineers, Directors of Public Works, Other Municipal Officials having equivalent degrees of responsibility	189
Assistant City Engineers, Bureau Heads, Other Municipal Officials	218
County, State, Federal, and Special District Officials	55
Consulting Engineers	124
Professors, Editors, Public Utility Engineers and Others	82
Commercial	96
TOTAL	764

An analysis of the 764 members, when compared with a similar analysis made a year ago, discloses the fact that despite our net decrease in membership we have increased the number of city engineers, directors of public works, and other municipal officials having equivalent degrees of responsibility. Almost all of the membership decrease can be accounted for by the reduction in "assistant city engineers, bureau heads, other municipal officials."

U. S. Cities Represented in Membership

Population Group	Number of Cities in Group	In A.P.W.A. by Ranking Public Works Officials	Cumulative Number of Cities	Cumulative Number of Cities in A.P.W.A.	Cumulative Per Cent
500,000 and over	13	6	13	6	46
300,000 to 500,000	12	7	25	13	52
200,000 to 300,000	16	7	41	20	49
150,000 to 200,000	11	5	52	25	48
100,000 to 150,000	41	12	93	37	40
75,000 to 100,000	26	13	119	50	42
50,000 to 75,000	69	22	188	72	38
25,000 to 50,000	189	32	377	104	28
10,000 to 25,000	606	34	983	138	14
2.5 to 10,000	2183	15	3166	153	5

We have also increased slightly the number of cities represented in the Association's membership by ranking public works officers,

153 at present against 150 last year. An analysis of a number of cities represented by ranking officials in the membership of the Association, on the basis of population groups, is shown in the above table.

Financial Status

There is appended to this report a statement of the receipts and disbursements of the Association for the eight months ended August 31. This statement includes the budget figures established by the Executive Committee at its meeting in Chicago in December, 1937. Careful study of this statement indicates that the expenditures for the remaining month of the calendar year can be kept within the estimated revenues.

Yearbook

The 1938 Yearbook was given publication on May 5. For the first time the content of the Yearbook was extended beyond the Proceedings of the 1937 Public Works Congress to include a considerable amount of material especially prepared for Yearbook publication. This special material was assembled with a view to presenting briefly the most salient developments in the public works field during 1937. The standing committees of the Association, members of the Association, and specially qualified students of the public works field not represented in our membership, made invaluable contributions to its preparation. In amount the additional material was about equal to the 1937 Convention Proceedings, which made the 1938 Yearbook the largest volume yet published by the Association.

The number of commendatory letters that have been received gives evidence that this departure from past practice has made the Yearbook a more valuable document. Further, the sale of the book so far this year to those outside our membership has already exceeded the sale of last year's volume for all of 1937.

Research and Publication

Street Cleaning Practice, the work upon which our research program has been concentrated, was completed in draft form in April. In June the Street Cleaning Committee held a meeting in Chicago and after considerable discussion of the subject matter, ap-

proved it for publication. Copy was sent to the printer in July and the book was completed and distributed to the membership of the Association on September 15.

Chapter VIII of *Street Cleaning Practice,* dealing with snow removal, was printed in mimeograph form in January immediately upon the approval of that chapter by the Street Cleaning Committee. It was then made available to the membership upon request and offered for sale to non-members. Up to August 31, 302 copies of this publication were given distribution, of which 107 were sold.

A new specification for sewer construction was prepared by the Specification Committee on Sewers and submitted to the Board of Directors for approval on February 9. The Board gave approval to the specification subject to some minor modification, authorizing the executive director to clear with the chairman of the committee as to the alterations required. All changes were made without difficulty with the exception of a brief provision for the driving of timber piles by steam hammers. As soon as this section is received from the committee chairman, the specification will be forwarded to the printer.[1]

With the approval of the Executive Committee, the Association's research activities were focused upon the completion of the study of experiences in sewer rental law administration immediately upon completion of the study of street cleaning. The sewer rental law study is being made in cooperation with the Municipal Finance Officers Association and the American Municipal Association. Data have been assembled from more than 100 cities using this method of financing sewer service and the analysis of these data and the preparation of the text presenting them are now nearing completion. Publication should be given to the study within the next two months.[1]

The study of refuse collection and disposal practices, a companion study to that on street cleaning, is to be carried through to completion as soon as the study of sewer rental law administration is out of the way. A large share of the first draft has been completed but there is a considerable amount of field work and correspondence still to be undertaken for the purpose of providing supporting data and illustrative material.

In addition to publications produced by the Association itself,

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[1] Now available.

Our Cities, the report of the Urbanism Committee of the National Resources Committee, was distributed to 160 members of the Association upon their request. Special arrangements had been made with the National Resources Committee to make this possible.

The total number of publications distributed by the Association for the year ended August 31, was 1,544, not counting the News Letter. The News Letter circulation for the year was 26,900. The distribution of *Street Cleaning Practice* on September 15 was 641 copies.

Inquiries

The number of inquiries on public works practice received by the headquarters office is still increasing steadily. Where the number received last year was 75, the number received during the period of this report was 143. Many of these inquiries involved extensive searches in the library and examinations of municipal reports.

It is interesting to note that of the 143 inquiries received, only 41 were received from members of the Association, the remaining 102 being received from non-members.

The subjects of these inquiries were as follows:

Organization and Personnel	11
Finance, including Sewer Rental	20
Equipment and Materials	9
Refuse Collection	27
Street Cleaning	12
Streets and Roads	13
Traffic	6
Sewerage and Sewage Disposal	16
Water Supply	9
Miscellaneous	20
	143

Field Work and Miscellaneous Activities

At the request of the secretary of the Wisconsin League of Municipalities, the executive director made an address at the annual meeting of that Association in September, 1937.

Late last fall the executive director was requested by the National Resources Committee to serve as a member of a public works committee to consult with the Bureau of the Budget concerning the setting up of the 1939 federal public works budget. This invitation was accepted and the work involved extended over several weeks. Other members of the committee were Col. Henry M. Waite, chair-

man, John S. Coleman of New Orleans, Frederick H. Fowler of San Francisco, and F. E. Schmitt of New York.

The executive director in February was engaged for a brief period by Public Administration Service to assist in making a survey of the public works activities of Wheeling, W. Va., for the government of that city.

In March Mr. Hebden, assistant director, was loaned for a two weeks' period to Public Administration Service to assist in the installation of a refuse collection and disposal cost accounting system in Montclair, N. J. While there he worked under the direction of Carl Schneider, member of this Association. The work was being performed for Stuart Weaver, Assistant Director of Public Works, also a member of the Association.

In December Mr. Pinel, research director, delivered a lecture on street cleaning methods at Wayne University, Detroit, to members of the staff of Detroit's Department of Public Works. This lecture was presented at the request of L. G. Lenhardt, then Commissioner of Public Works of Detroit, a member of the Board of Directors of this Association.

"The City and Its Public Utilities" was the subject of two lectures given by the executive director in March at the Wilson Junior College in Chicago.

In July the executive director was again requested by the National Resources Committee to work with Colonel Waite in planning the federal public works budget for 1940, an assignment similar to the one accepted in the fall of 1937. Also, he was requested to advise the National Resources Committee on a project being prepared to promote and assist the programming of public improvement by local governments. Both these requests were accepted.

At the request of the secretaries of the California and Texas Leagues of Municipalities, the executive director undertook a field trip through California and Texas cities in April. In California he met at San Francisco with the Board of Directors of the California League of Municipalities, which includes two members of our Association, and addressed the meeting of the city engineers' division of the League at San Diego. He also made an address at the annual meeting of the California Sewage Works Association at San Diego. While in California he called upon the city engineers of Berkeley, Oakland, Fresno, Los Angeles, Pasadena, and San Diego. In Texas a meeting was held in Fort Worth which was attended by the

secretary of the Texas Municipal League and a group of city engineers. The subject given discussion in both California and Texas was the establishment of sections of our Association in those states.

Annual Reports of Chapters

ROCHESTER CHAPTER

The Rochester Chapter held its first meeting of the 1937-1938 year on December 20, 1937, at which time F. C. Sellnow, Resident Engineer in Charge of Construction, and C. R. Velzy, Resident Engineer in Charge of Design for Greeley & Hansen, Consulting Engineers for the Buffalo Sewer Authority, explained the general design of the intercepting sewer system and sewage disposal works and the general construction features of the sewer, intercepting chambers, etc., being carried on under the Buffalo sewer P.W.A. projects. Both talks were illustrated by lantern slides. These talks proved extremely interesting to the members of the Rochester Chapter as the city is starting a program for the construction of a number of tunnel sewer projects.

On May 23, 1938, the annual meeting of the Rochester Chapter was held and the following officers were elected for the years 1938 and 1939:

John V. Lewis	President
Meloy Smith	1st Vice-President
Kenneth J. Knapp	2nd Vice-President
Henry L. Howe	Secretary-Treasurer
Edwin A. Miller	Executive Committee
Morgan D. Hayes	Executive Committee
A. H. Wagener	Executive Committee

Following the election of officers, the Secretary-Treasurer gave the Treasurer's report for the Chapter, as shown in detail in the minutes of the meeting of May 23, 1938, showing the net worth of the Rochester Chapter, before deducting the expenses of this annual meeting, as $396.12.

The membership of the Rochester Chapter on June 30, 1938 was 42. Two members resigned during the year.

Following the business meeting, President Hayes introduced the speaker of the evening, Commissioner Harold S. W. MacFarlin, who spoke on the organization of the new Department of Commerce of the City of Rochester. Mr. MacFarlin explained the local law enacted by the City Council creating this new department, and stated in brief that the department had supervision and control of public relations, enforcement of restrictions pursuant to the zoning ordinance, city-owned public markets, terminals, ports, railroads, transportation systems, inspection of weights and measures, and of the real property, exclusive of school property, owned by the city; further, that it was the duty of the Commissioner of Commerce to see that the terms and conditions imposed in favor of the city in any public utility franchise were faithfully performed. The Commissioner of Commerce also has supervision and control of the promotion of the industrial, commercial, labor, and general betterment of the city, and is a member of the City Planning Board.

CHICAGO CHAPTER

During the year the Chicago Chapter continued its practice of holding dinner meetings, usually preceded by an inspection trip.

The first of these meetings during the fiscal year was held on December 4, 1937, in the form of a conclave for public works officials, operators, and engineers. The program started at 2:00 P.M. with an inspection of the new Outer Drive Bridge and its approaches. This bridge had recently been completed by the Chicago Park District. At 5:00 o'clock a fellowship meeting was held at the Harding Hotel and liquid refreshments were plentiful. Following the dinner at 6:30, R. C. Doyle displayed his unusual talents as toastmaster. Dr. T. C. Poulter, Chief Scientist and Second in Command of the Byrd Antarctic Expedition in 1935, now Director of Research of the Research Foundation of Armour Institute of Technology, then entertained the approximately sixty-five people present with moving pictures, *Daily Life at Little America.*

On January 27, 1938, the Chapter held a dinner meeting at the Georgian Hotel in Evanston. Robert Kingery, manager of the Chicago Regional Planning Association for more than ten years.

delivered an illustrated talk on the Chicago regional plan, which is quickly proving to be of tremendous benefit to the community.

On March 24 a dinner meeting was held at the Hotel LaSalle, following which Joshua D'Esposito spoke on "Transportation Developments in the Chicago Area."

The Chapter inspected the new sewage treatment plant at St. Charles, Illinois, on Friday, May 13, 1938, and also the municipal water plant. Dinner was served at the Hotel Baker and, at the short business meeting following, officers for the next term were elected as follows:

Paul Hansen	President
H. B. Bleck	1st Vice-President
R. C. Doyle	2nd Vice-President
Harold Vagtborg	Secretary-Treasurer

Walter Sperry, Superintendent of the Aurora Sanitary District, then presented a most interesting illustrated lecture entitled, "Sanitation in the Fox River Valley in the Last Ten Years."

On Friday, June 17, 1938, the Chapter met in the National Headquarters of the American Public Works Association recently moved to a new building at 1313 East 60th Street. Inspection was made of the building followed by a dinner at the Hotel Plaisance. Frank Herring then explained the history and development of the manual, *Street Cleaning Practice,* and Stanley Pinel, the Association's Director of Research, led a very interesting and spirited discussion on the book.

Because of the interest shown in the kind of meetings held during the year it is planned to continue the same type during the coming year.

Financial Status

Cash on hand August 31, 1937 (date of last report)		$375.35
Received from parent group (dues)		122.50
TOTAL		$497.85
Less expenditures as follows:		
To A.P.W.A.:		
Expense June 21, 1935 meeting	$82.20	
Expense April 3, 1936 meeting	18.51	
Expense January, 1937 meeting	1.95	
Expense April, 1937 meeting	14.85	$117.51

Expense December 4, 1937 meeting:			
Harding Hotel	41.00		
DeVry, Inc.	17.00		
Pipes and tobacco	5.36	63.36	
R. R. Donnelley & Sons Company, stationery		36.19	
Expense March 24, 1938 meeting, entertainer		30.10	
Expense May 13, 1938 meeting (R. C. Doyle)		5.97	
Expense June 17, 1938 meeting (Harold Vagtborg)		8.04	261.17
BALANCE			$236.68

On deposit Northern Trust Company	$134.68
On deposit Wilmette State Bank	71.50
Petty Cash Fund	30.50
	$236.68

ST. LOUIS CHAPTER

THE St. Louis Chapter of the American Public Works Association held several inspection tours during the past year which were followed by dinner and the business meeting.

The inspection tours included the new sewage disposal plant of the City of Kirkwood and the new filtration plant of the St. Louis County Water Company.

This type of meeting is most successful. The information gathered during the inspection is valuable, the dinner is enjoyable, and the discussion during the business meeting and after is far more interesting than can be obtained in the lecture type of meeting. Those present were most enthusiastic about this kind of meeting.

The Secretary-Treasurer of the Chapter reported a balance of $211.11 of which $21.58 is still held in a closed bank.

METROPOLITAN PHILADELPHIA CHAPTER

THE main event of the year for the Metropolitan Philadelphia Chapter was the celebration of the 25th Anniversary Dinner on January 27, 1938 at the Engineers Club in Philadelphia. The dinner was attended by more than 200 public works engineers and

officials located within the Metropolitan Philadelphia region. The Chapter was fortunate in securing as the principal speaker the founder President, Morris Llewellyn Cooke. Other speakers appearing on our program were Walter H. Thomas, Executive Director of the Philadelphia City Planning Commission and Project Engineer of the Philadelphia Housing Authority, and Charles S. Shaughnessy, Chief Examiner, Philadelphia Civil Service Commission. The toastmaster was Harry S. McDevitt, President Judge, Common Pleas Court No. 1., Philadelphia. Many of the charter members were present and recalled the founding of the Chapter in 1912 as the Philadelphia Society of Municipal Engineers by Mr. Cooke, who was then Director of the Department of Public Works, Philadelphia, during the reform administration of Mayor Rudolph Blankenburg.

A feature of the dinner was the presence of all the living Past Presidents of Philadelphia Chapter, who were seated at a special table and who answered individually a special roll call of those present, an interval of silence being observed for those who have answered the final roll call. Sixteen Past Presidents of the Philadelphia Chapter were present at the dinner and four have passed away in the quarter century of our existence. Thomas Buckley acted as spokesman for the Past Presidents and made an inspiring address that was enthusiastically received by those present and that set vibrating again the chords of memory among those who recalled the stirring years that followed the founding of the Philadelphia Chapter—the periods of storm and vicissitude but the greater periods of success and triumph in attaining the objectives for which we organized 25 years ago.

T. Elmer Transeau, Assistant Director of the Department of Public Safety, Philadelphia, received the gold medal award for meritorious service. The award was made at the Anniversary Dinner by Frank W. Herring, Executive Director of the American Public Works Association, who read the citation accompanying the award. Mr. Herring has honored our Chapter with his presence at our annual dinners several times in the past and has endeared himself to our members and guests by his pleasing personality and cooperation with the officers and members of our Chapter.

Our annual dinners are becoming such large affairs and the attendance at our monthly meetings so great that it was decided by the Board of Directors that strict attention should be given during the year to perfecting our machinery for handling these affairs. The

Dinner Committee was enlarged under the chairmanship of Benjamin S. Berry to include Messrs. Samuel S. Baxter, Herman Krohn, Albert W. Moser, and Ben H. Joseph. By their mastery of details and alertness in introducing innovations and novelties that contribute so much to the pleasure and good feeling that accompany our annual dinners, they have done much to build up the good will and prestige now enjoyed by the Philadelphia Chapter in the metropolitan region.

The Board of Directors realized that the increasing prominence given by the press to our dinners, our group speakers, and our monthly meetings would soon require the formation of a committee to handle reporters, poster advertising, monthly meeting notices, press releases, and additional local publicity for the national conventions. A strong Publicity and Public Relations Committee was organized to put these matters upon a smoothly functioning basis. Favorable results are rapidly apparent as a result of the labors of this committee. The committee was fortunate in securing the acceptance of membership by John H. Hunter, 2nd, Traffic Signal Engineer and artist whose poster designs advertising the meetings of the Chapter have attracted widespread attention and done much to stimulate attendance at our meetings.

A Reception Committee was created to handle our group speakers, our guests, and to expedite the matter of introductions at our monthly meetings. Incidentally the contacts made by this committee are of great value in securing additional members. The membership on our various committees was made interlocking in order to facilitate cooperation in routine work by the various committees.

The attendance at our monthly meetings averaged 75. The roster of meetings for the year was as follows:

Speaker	Subject
October 1937: Messers. Buckley, Rosengarten, Shaughnessy, Williams, King, Hesselbacher, Thorpe, Ogden, Kohler, Thomas, and Mitchell (interlocutor)	*Informal panel featuring the highlights of the Atlanta convention*
November 1937: Mr. Connors, Chief Engineer of Water Sup-	*A reunion of public works engineers from the sister states*

Speaker	Subject
ply, State of New Jersey; Mr. Braun, President of Society of Registered Engineers, New Jersey; Mr. Hewitt, Planning Engineer, Camden, New Jersey; Mr. Daly, City Engineer, Camden, New Jersey; Mr. Williams, Engineer, State Highway Department, New Jersey; Mr. Hartmann, Director of Public Works, Camden, New Jersey (sponsor)	
December 1937: Christmas Party	
January 1938: 25th Anniversary Dinner	
February 1938: Morris M. Cohn, Sanitary Engineer, Schenectady, New York; William S. Canning, Engineer-Director, Keystone Automobile Club; Francis H. Buzzard	*A New Era in Waste Disposal* *The Engineer's Contribution to Public Safety* *Water Demand for Air-Conditioning*
March 1938: Motion pictures and discussion by members	*New Engineering Constructions: New Lincoln Tunnel, George Washington Bridge. Transite Sewer Pipe*
April 1938: Samuel S. Baxter, Bureau of Engineering, Surveys and Zoning, Philadelphia, read paper of Chester D. Albright, formerly Chief Engineer and Surveyor, Philadelphia	*Thomas Holme's Survey of Philadelphia with its Relation to the Philadelphia Standard of Measurement, and the Original Plan of Philadelphia as Conceived by William Penn and his Surveyor General*
May 1938: Junior Engineers' Night William H. McGarvey (sponsor);	*The Development of the S. Davis Wilson Airport*

Speaker	Subject
David Anderson	*The Allegheny Avenue Grade Crossing*
William Cattell	*Surveying as Practiced in the City of Camden, New Jersey*
Paul MacMurray	*Municipal vs. Private Collection of Garbage*
Henry Hopkins	*Storm Drainage Problems in a Rapidly Developing Community*

The meetings were arranged by Robert A. Mitchell, Chairman of the Meetings Committee. The Chapter is indebted to him and the members of the committee for their untiring efforts to provide a delightful and entertaining series of meetings.

The membership of the Philadelphia Chapter has been maintained at 120 members. There have been three resignations, two new full-fledged members, and three new junior members. In accordance with Article (b) of Section 3 of the By-Laws, the Chapter has continued its traditional policy of encouraging the younger members of the profession by opening up Junior Chapter membership, and the Secretary was instructed at the Board Meeting, March 24, 1938 to prepare a specially designed membership card for Junior Members. The Chapter acknowledges with appreciation the work of Albert W. Moser, Chairman of the Membership Committee, and his colleagues.

Memoria: The death of Isaac Stanley Walker left a gap in the ranks of the men active in the work of administration of the Metropolitan Philadelphia Chapter that is hard to fill. Mr. Walker was a member of the Board of Directors and gave generously of his time and talents to our work. He was for many years a member of Philadelphia Chapter. He was engaged in private practice as a consulting engineer specializing in water supply projects and had developed a large practice in his special field.

The meetings of the Board of Directors were uniformly well attended and many worth-while innovations were made looking to improvement in the conduct of the Chapter's affairs. Emphasis was placed upon the urgent necessity for improving the machinery for

handling the multitudinous affairs pressing upon Chapter officers and committees. A great deal has been done along these lines and plans and policies are still being formulated for the perfecting of methods for handling routine business as well as the more spectacular affairs of the Chapter.

At the request of the Engineers Club of Philadelphia, nominations for the post of Chapter Representative on the Technical Service Council and also Representative on the Council of Affiliated Societies were made and Edward J. Dauner was appointed to the position on March 24, 1938. At this meeting the President appointed Messrs. Corson (chairman), Moser, Hafner, Baxter, Transeau, and Gibbs as the Nominating Committee to prepare nominations for the annual election of officers of the Chapter. At the Board of Directors meeting, Thursday, April 8, 1938, Mr. Corson presented the selections of the Committee as follows:

Robert A. Mitchell	President
George E. Hesselbacher	3rd Vice-President
Joseph C. Gibbs	Secretary
Frank L. Thomas	Treasurer
Thomas Buckley	Directors (To serve three years)
A. W. Moser	
Louis Schneider	
A. C. Williams	

After compliance with the provisions of the By-Laws governing the nomination and election of officers of the Chapter, the nominees were duly elected and inducted into office at the monthly meeting held Thursday, May 26, 1938.

The report of Frank L. Thomas, Treasurer of the Chapter, submitted at the last meeting of the Board of Directors, held May 26, 1938, is as follows:

Receipts, Cash on hand deposited in Saving Fund Society of Germantown and Vicinity	\$114.88
Expenditures for May Meeting	7.02
Cash on hand deposited in saving fund	\$107.86
Additional balance in two closed bank accounts	\$337.59

Philadelphia Chapter, after 25 years of life as an organization of public works engineers and officials, faces the future with courage and optimism; we are undismayed by our reverses, greatly en-

couraged by the many successes and triumphs we have achieved in a quarter century's existence and are confidently looking forward to many years of life and service to the public works engineers and officials of Metropolitan Philadelphia. Under the dynamic leadership of Robert A. Mitchell, our new President, the objectives for which we are organized are certain to be carried to new and higher levels of achievement.

NEW ORLEANS CHAPTER

THE following report covers the activities of the New Orleans Chapter for the fiscal year 1937-1938:

Three regular meetings and one executive meeting were held, as listed below:

November 19, 1937. Executive Committee Meeting convened for the purpose of organizing committees to function throughout the ensuing year, and to plan the Chapter's activities for the year.

April 22, 1938. Regular meeting at which Robert J. Kuhn spoke on "A Proposed Lake Borgne to Gulf Waterway."

May 27, 1938. Regular meeting at which Captain Lawrence H. Stevens spoke on "Tribute to Season."

FINANCES

On Hand—June 24, 1937	$181.30
Receipts (dues)	67.50
TOTAL	$248.80
Disbursements	109.64
Balance on hand June 10, 1938	$139.16
Owed Chapter by delinquent members	16.50
TOTAL	$155.56

Four members are in arrears. Dues owed to Chapter by these delinquent members amount to $16.50. No new members have been added during the past year and the Chapter lost two members. Carl Schneider has been added to our roll, as he has recently moved back to the city. The total membership is now 28, which includes 1 Senior member, 2 Associates, and 25 regular members.

During the past year our program committee has endeavored to secure prominent speakers, but greater cooperation from the membership in turning out for the meetings is essential.

MICHIGAN CHAPTER

This is the second annual report of the secretary of the Michigan chapter of the American Public Works Association. The annual meeting was held in connection with the Michigan Municipal League convention in Saginaw on September 16, 1937, and was attended by ten of the members of the association together with approximately twenty-five other municipal engineers in Michigan. Officers for the new year were elected as follows:

President, C. R. Wightman, Director of Public Works, Benton Harbor
Vice-President, John H. Moorhouse, Director of Public Works, Highland Park
Secretary-Treasurer, H. A. Olson, Acting Director, Michigan Municipal League
W. J. Wallace, Chief Paving Engineer, Detroit
George H. Sandenburgh, City Engineer, Ann Arbor
Sam C. Jacka, City Engineer, Lansing

The total membership of the Chapter as of this date is twenty-six. Refunds to the Chapter totaling $65 were transferred to the general League account as previously agreed upon.

Meetings of the Association Divisions

October 3, 1938

The three Divisions of the Association—the Administration Division, the Design and Construction Division, and the Maintenance and Operation Division—each met on Monday morning, October 3, at the annual convention and elected a chairman for the ensuing year. (The chairman of each Division serves as a member of the Board of Directors.)

Prior to turning the meeting over to the Division chairmen, President Root appointed the Nominating Committee for the selection of Association Officers and Directors, comprising F. T. Thorpe, chairman, E. S. Rankin, A. M. Anderson, G. R. Byrum, and W. B. Shafer.

L. G. Lenhardt then took the chair, and called for the report of the Nominating Committee for the Administration Division. The committee renominated Mr. Lenhardt who is general manager of the Detroit Water Board, and it was moved and carried that a unanimous ballot be cast for Mr. Lenhardt's re-election as chairman of this Division. Mr. Herring so cast the unanimous vote.

The meeting was then turned over to H. D. Bradley, chairman of the Maintenance and Operation Division, who was also unanimously re-elected as chairman of this Division for the ensuing year.

F. T. Paul, chairman of the Design and Construction Division, then assumed the chair, and the Nominating Committee for this Division reported the selection of F. R. Storrer, city engineer, Dearborn, as chairman. A motion that Mr. Storrer be unanimously elected was put to a vote and carried.

As there was no other business, the meeting adjourned at 12:15 P.M.

Business Meeting of the American Public Works Association

October 4, 1938

THE ANNUAL business meeting of the American Public Works Association was held in New York City, on Tuesday, October 4, 1938. J. Eugene Root, President of the Association, presided.

The Nominating Committee reported its nominations for the officers of the Association and the Board of Directors as follows: Guy Brown, *President;* John S. Flockhart, *First Vice-President;* Roy L. Phillips, *Second Vice-President;* Frederick T. Paul, *Treasurer;* and William B. Shafer and Frederick R. Storrer, *Directors.* Mr. Buckley moved that the nominations be closed and that a unanimous ballot for the nominees be cast. The motion was seconded and unanimously carried.

President Root then called upon a committee appointed by the Board of Directors to recommend candidates for honorary membership in the Association. The following distinguished members of the American Public Works Association were recommended by the

committee and had conferred upon them by unanimous vote the title of honorary member: A. Prescott Folwell, New York City, editor of *Public Works;* E. A. Fisher, Rochester, New York, consultant for the City of Rochester; and E. S. Rankin, Newark, N. J., Engineer, Division of Sewers.

The executive director was called upon, and he read his annual report. (See page 340 for the text of this report.)

President Root then appointed the following as members of the Resolutions Committee: W. E. Rosengarten, chairman, H. D. Bradley, and F. T. Paul.

The Auditing Committee reported that it had examined the report of the Treasurer and had found it to be correct. It was moved, seconded and carried that this report be adopted.

A suggestion was made by F. J. Hartmann that consideration be given to having the members in convention take some action on those papers presented which imply that action would be desirable. He felt that such a procedure would serve to stimulate the interest of the members in the papers and in the convention.

The necrology report was presented by the executive director as follows: During the period September 1, 1937, to August 31, 1938, the deaths of seven members of the Association have been reported. The deceased members are as follows: Clarke Peleg Collins; C. Arthur Poole; Isaac Stanley Walker; J. G. Barbour; Edward H. Gerlach; James Hervey Dingle; and Bernard L. Crozier.

The meeting adjourned at 12:40 P.M.

Necrology Report

CLARKE PELEG COLLINS, age 69, died September 19, 1937 at his home at Clarksburg, West Virginia. At the time of his death he was employed by the Public Works Administration and had just completed supervision of the installation of sewers at Mason and South Parkersburg, West Virginia. He joined the A.M.E. in 1909 and became a senior member of the Association January 1, 1937. He was a graduate of the Friends School, Providence, Rhode Island, and had one year at Rensselaer Polytechnic Institute. He served as member of the staff of the City Engineer of Providence from 1888 to 1890; from 1890 to 1900, as Assistant Engineer in the Mining Engineering and Survey Department of the Cambria Iron Company of Johnstown, Pennsylvania. In 1900 he entered private

practice as Consulting Civil Sanitary and Mining Engineer at Johnstown. He became Special Engineer for the Berwind White Coal Mining Company in 1912, where he designed treatment plants for water supply and disposal of sewage for mining hamlets for Windber, Pennsylvania. From 1914 to 1918 he served as Sanitary Engineer of the City of Johnstown, and for the next two years as Senior Engineer of the United States Government Shipping Board, Merchants Emergency Fleet Corps at Washington and Philadelphia, in charge of sewerage, drainage and sewage disposal for 18 housing projects built to serve the merchant-ship yards. In 1920 he resumed private consulting practice at Clarksburg, West Virginia. His work during this time included reports of valuations of mining properties and sanitation for mining communities in Pennsylvania, Maryland, West Virginia, and Kentucky.

C. Arthur Poole, who died October 14, 1937, age 63, at Niagara Falls, New York, at the time of his death was Resident Engineer for P.W.A. in charge of the construction of a two-million-dollar sewage disposal plant which was nearing completion. He joined the A.M.E. in 1918. He received his engineering degree from Princeton in 1895. He went to Norway in 1900, where he was engaged for four years in railroad construction. From 1904 to 1909 he was Resident Engineer on one section of the New York Barge Canal Improvement Project. He was associated with a New York firm of railroad contractors from 1909 to 1917. During the war he served as Captain in the Engineering Corps, and from 1919 to 1928 as City Engineer of Rochester, New York; as Consulting Engineer to the City from 1928 to 1931; as City Manager, 1931 to 1932; 1932 to 1934, City Engineer. In 1934 he left the City Engineer's office to take charge of federal construction of a city sewage disposal plant; then in 1935 he went to Niagara Falls as P.W.A. Resident Engineer in charge of construction of a new municipal filtration plant. Mr. Poole was a past director of the American Association of Engineers, a past president of the Rochester Engineering Society, and a director of the American Society of Civil Engineers.

Issac Stanley Walker, Consulting Engineer in Philadelphia, specializing in water supply and sewage works, died January 23, 1938, age 54, at his home in Frankford, Pennsylvania. He was a

graduate of Temple University and Drexel Institute, and joined the A.M.E. in 1923. From 1906 to 1911 he served as Assistant Engineer and later Principal Assistant Engineer to the Philadelphia Bureau of Water; 1911 to 1917 he was associated with the firm of Hering & Gregory, New York City. He taught Sanitary Engineering at Columbia University in 1915 and 1916, and in 1918 became Assistant Engineer in the Sewage Disposal Division of the Bureau of Surveys of Philadelphia. Later he became General Engineer of the Delaware Water Supply Company and then of the New Chester Water Company and Pennsylvania Water Service Company from which position he resigned in 1930. In 1930 he went to Russia to plan a water supply and sewage system for Moscow. At the time of his death he was serving the National Resources Committee as Associate Consultant and had been engaged in a special study of water supply conservation in the Delaware River Basin.

J. G. Barbour died February, 1938, age 84, in Florida. At the time of his death he was Secretary-Treasurer of the Metropolitan Paving Brick Company of Canton, Ohio. He was a graduate of the University of Pittsburgh and a member of the Allegheny Bar Association. During the nineties he was associated with the brick manufacturing industry, and became associated with Metropolitan Paving Brick Company when it was founded in 1904. In addition to his association with that company he was Secretary and Treasurer of the Cleveland Brick and Clay Company, Cleveland, Ohio, and Secretary and Treasurer of the Sterling Brick Company of Olean, New York. He was Chairman of the Rate Committee of the National Paving Brick Association. He joined the A.M.E. in 1911.

Edward H. Gerlach, who died March 23, 1938, at his home in Milwaukee, Wisconsin, age 49, at the time of his death was Superintendent of Garbage Collection and Disposal for the City of Milwaukee. He joined the I.A.P.W.O. in 1929. From 1907 to 1912 was employed as Estimator for a lumber company; from 1912 to 1915, Landscape Architect. In 1915 he entered the service of the City of Milwaukee as Ward Superintendent in the Bureau of Street Sanitation. He became Supervisor of Garbage and Ash Collection in 1923 and in 1933 was made Superintendent of the Bureau.

JAMES HERVEY DINGLE, who died June 3, 1938, at the Riverside Infirmary in Charleston, South Carolina, at the time of his death was City Engineer of Charleston. He joined the A.M.E. in 1908 and became a senior member November 1, 1937. He received the A.B. degree in 1888 from the College of Charleston, and the degree of C.E. in 1892 from Cornell University. In 1893 he entered the service of the City of Charleston as Assistant City Engineer. He became City Engineer in 1894, a position he held until the time of his death. In 1931 he was a recipient of the Veteran's Award Medal of the Association for long and faithful service.

BERNARD L. CROZIER, at the time of his death Chief Engineer of the Department of Public Works of Baltimore, died July 23, 1938, age 48, in Baltimore. He joined the I.A.P.W.O. in 1931. He attended Alabama Polytechnic Institute for three years and also the Baltimore Law School and was admitted to the bar in 1911. He was employed in 1910 as a rodman, Baltimore & Ohio Railroad; in 1911 as a rodman, United Railroads and Electric Company of Baltimore. During this year he also was Inspector for the Maryland State Roads Commission. From 1912 to 1923 he served the Paving Commission of Baltimore, first as Assistant Engineer and later as Office Engineer in Charge. He was Highway Engineer of Baltimore from 1923 to 1925. From 1925 to 1927, he was Chief Engineer and Head of the Public Works Department. He engaged in private consulting practice in Baltimore from 1927 to 1929, and then was made Chief Engineer of the Metropolitan District of Baltimore, which position he resigned in 1931 to resume his position as Chief Engineer of the Public Works Department.

Committee Reports

THE COMMITTEE ON STREET CLEANING

THE MAJOR work of this Committee during the past two years has been the preparation of the manual on street cleaning practice. This work was completed and approved by the Committee during the summer of 1938 and in September the printed volume,

Street Cleaning Practice, was distributed to each member of the Association. The manual is, in reality, the report of the Committee, and as such has been submitted for your approval.

In the Foreword, the history of the volume is traced from the date of the authorization of the work in 1935 by the Joint Administrative Board of the American Society of Municipal Engineers and the International Association of Public Works Officials. Since that time a vast amount of research work, correspondence, field work, and organization of material has been accomplished by Stanley I. Pinel, Research Director, and the Committee, resulting in the finished product. The members of the Committee desire to recognize especially the work done by Mr. Pinel, and to take the opportunity before the assembled convention to commend him for his efforts in producing the manual. His work has been of the highest grade and the value of his services has been inestimable. To Frank Herring, Executive Director, to Robert B. Brooks of St. Louis, Missouri, and to the many public works officials who have cooperated in the work, the Committee desires to express its appreciation.

To have produced this book would have been quite impossible without the financial assistance of the Spelman Fund and the Committee gratefully acknowledges their grant of funds.

It is our hope that the manual will serve as a guide in the field of street cleaning practice.

John S. Flockhart, *Chairman*
Harold D. Bradley
William J. Galligan
Joseph E. Gill
Alfred E. Roche
William B. Shafer
William A. Xanten

THE COMMITTEE ON SPECIFICATIONS FOR BRICK PAVEMENTS

The Committee on Specifications for Brick Pavements has had considerable correspondence during the year, and five of the seven members were together in Cincinnati in January at the meeting of the National Paving Brick Association. The Committee

wishes to present again its recommendation of last year that the practice for laying brick around curves outlined in our specifications, page 9, paragraph 7B, is not considered good practice at the present time. The Committee again recommends that this entire first paragraph be eliminated and the following paragraph substituted:

> On curves, the brick shall be laid with close joints just as on the straight pavement until the line of the brick on the outer edge of the curve shall have fallen back approximately 1½′ from a radial line. At this point the line of the next course shall be moved ahead approximately 3′ on the outer side of the curve and the laying with close joints started as before. The resulting unpaved wedge having its point on the interior of the curve and a base of approximately 3′ on the outside of the curve shall be filled by laying as many whole brick as possible in courses parallel to the original alignment of courses. The remaining spaces between courses shall be filled with brick laid longitudinally at right angles to one of the transverse courses at each successive closure.

These instructions will then be completed by leaving in place the next paragraph which reads:

> No portion of a brick less than three (3) inches in length shall be used for batting such closures and the amount of space to be batted in shall, by varying the length of the successive transverse courses, not exceed a whole brick.

The above correction should be submitted according to whatever practice may be necessary to legalize it and make it a portion of the regular specifications of the Association.

The membership of the Committee is united in its recommendation for the elimination of blast furnace slag for bed purposes under any conditions and is more convinced than ever that sand cement material should not be used under pavements with soft fillers. They are also unanimous about the advantages of rolling brick on boards, mentioned in last year's report, and anticipate presenting in the near future an alternate specification for this method of rolling.

The search goes on for the ideal filler and many experiments are under way. It seems impossible to obtain a straight asphalt having sufficiently low penetration to prevent exuding and a high enough viscosity to provide sufficient adhesiveness to properly bond the filler to the brick. Blended asphalt and mastics are still widely studied. It is said to be impossible to write specifications that will provide the exact blend desired on open competitive bidding. Some straight asphalts will apparently meet the requirements of any open

specifications that may be written but will not perform the same in practice. We have also learned that asphalts differ in their durability and their resistance to weathering. Research engineers tell us that some of them seem to lose their original characteristics at a greater rate than others. Perhaps asphalts from certain sources should be entirely excluded from good specifications covering brick fillers. The Research Bureau of the Paving Brick Association is starting an investigation of the characteristics of asphalt fillers from the standpoint of durability.

Several interesting experimental roads are being laid. These include a vibrated monolithic brick pavement on U. S. Route 21 northwest of Massillon, Ohio, and a reinforced brick pavement on U. S. Route 23, 5 miles north of Delaware, Ohio. The monolithic type consists of a 3″ monolithic brick surface course without cushion on a 9-7-9″ reinforced concrete base course. Expansion joints are provided throughout the depth of the pavement. This work differs from the old type of monolithic pavement in the fact that cracking is reduced by proper provision for expansion and both the concrete base and the brick laid on the green concrete are vibrated into place by a vibrating machine. A reinforced brick pavement near Delaware, Ohio, is constructed of special brick on a concrete base reinforced with steel. Both of these pieces of work are new in design and construction methods and are worth a visit from anyone studying block pavement construction. Your committee is carefully watching the various ideas such as new types of filler, brick laid parallel to the axis of the pavement, various bedding materials, and many other experiments on which practice is not yet sufficiently standardized or the Committee not sufficiently in complete agreement to justify recommendations. Many of these ideas may justify recommendations as standard practice in the future and will be carefully watched by your Committee.

Roy L. Phillips, *Chairman*
Warren L. Barr
A. Mason Harris
W. L. Hempelmann
Lyons Mussina
William C. Perkins
George F. Schlesinger

THE COMMITTEE ON TRAFFIC CONTROL

THE principal lines of activity of the Committee on Traffic Control have been directed toward: (1) further work on the project which it inaugurated in 1937 of stimulating in cities and states which do not have traffic engineers the designation of a competent engineer to whom all engineering problems in the traffic field would be referred. It was believed that in a considerable number of jurisdictions it would not be deemed feasible at this time to employ a full-time traffic engineer. Where such conditions exist, the approach being recommended by the Committee produces beneficial results. In a good many cases the designated engineer will be given more and more responsibilities in the traffic field. If he is the right man, he will study the subject and prepare himself to become better fitted professionally to carry on traffic engineering functions. Already the activities of the Committee have shown that this is the case.

(2) As a result of the Committee's activities, thirteen men attended a Traffic Engineering Training School at Harvard University in August, 1937, and fourteen others who attended that school were probably attracted to it in part by the A.P.W.A. project. The activity also helped to produce attendance to two other traffic engineering short intensive training programs—a brief three-day session at the Pennsylvania State College, April 27-29 and a two-week short course in Traffic Engineering at the National Institute for Traffic Safety Training, University of Michigan, Ann Arbor, August 8-20. Through its Committee on Traffic Control, the A.P.W.A. was invited to cooperate in the conduct of these short training programs. It accepted in all cases.

A number of active national organizations, such as the General Federation of Women's Clubs, the National Congress of Parents and Teachers, and the National Safety Council were invited to cooperate in this project of the A.P.W.A. Through these channels, considerably more attention was directed to this desirable project. Managers and directors of 350 Motor Clubs affiliated with the American Automobile Association were also advised of both the project and the training courses and the suggestion was made that they cooperate. A follow-up letter was sent to selected members of the A.P.W.A. on January 30, 1938.

While it is difficult to appraise precisely the results obtained, enough is known of specific results to lead us to believe that the basic project is producing more favorable results even than were anticipated.

Present Activities

The Committee is continuing active promotion of its projects by placing emphasis at this time on a selected number of larger cities where more concentrated efforts are being made to find solutions to these problems.

In addition, a new approach is being recommended. It is realized that in many communities officials are unable to secure commitments for the designation of such a traffic engineer. Basically this reflects a lack of vigorous public opinion favorable to such a step. Your Committee, therefore, proposes that steps be taken to build such public opinion. Two specific steps are being taken:

1. A suggested form for an editorial dealing with the value of traffic engineering and with the specific project of our Committee has been prepared and is being considered by Committee members. In approved form, it will shortly be sent out together with a sheet giving formalized examples of typical traffic engineering accomplishments.

2. The C.I.T. Safety Foundation has conducted two splendid Seminars of Safety for key newspaper men in 100 cities throughout the country. Another such Seminar is to be conducted in Indiana, October 15, 16 and 17. The important newspaper men who attend these Seminars generally return to their communities with a firm determination to act on effective traffic improvement activities suggested. Working in cooperation with the C.I.T. Safety Foundation, letters are to be written to these men within the next few days, enclosing the suggested editorial and a summarized statement of accomplishments, suggesting that in light of their interest in traffic safety as shown by their attendance at the C.I.T. Seminar of Safety, they may wish to take some action along these lines. In all cases we are requesting that they advise us if such action is taken, and to send a copy, if possible, of any editorial carried in a newspaper or magazine.

It is also planned to prepare a short statement suitable for use on the radio and to utilize this in the selected cities where concentrated

attention is to be given to encouraging definite action on the Committee's suggestion.

Burton W. Marsh, *Chairman*
Lewis V. Bullis
Maxwell Halsey
Frank J. McDevitt
Theodore M. Matson
Robert A. Mitchell
A. J. Naquin
Earl J. Reeder

Meeting of Board of Directors

New York, N. Y. *October 5, 1938*

The annual meeting of the Board of Directors of the American Public Works Association was held on Wednesday, October 5, 1938, at the Hotel Pennsylvania in New York City. Guy Brown, president of the Association, presided and called the meeting to order at 12:30 p.m. Those present were: J. S. Flockhart, R. L. Phillips, F. T. Paul, H. L. Howe, W. E. Rosengarten, L. G. Lenhardt, W. B. Shafer, F. R. Storrer, Thomas Buckley, F. W. Herring, E. J. McGrew, Jr., and N. Hebden.

The minutes of the Board of Directors meeting held on Sunday, October 2, 1938, were read and approved.

Standard Specifications

Before discussing the status of several of the standard specifications, the regulations governing the adoption of such specifications were read. The executive director reported that the Sewer Specifications were being printed and it was agreed that they constitute a revision of the old specifications, and therefore, do not need to be published as tentative.

Henry L. Howe, chairman of the Specification Committee for Cement Concrete Pavements, reported that his committee had completed the task of redrafting specifications for concrete pavements. A motion was approved instructing the executive director to send a copy of the proposed specifications to each member of the

Board of Directors for review, to be voted on at the meeting of the Board in December. Messrs. Lenhardt and Shafer requested that they each be sent six copies of the proposed specifications for review purposes.

It was also agreed that the present Tentative Specification for Cold Laid Asphaltic Concrete Pavements be brought up for action at the December Board meeting.

Membership Awarded McGrew

In recognition of his untiring efforts as chairman of the Local Arrangements Committee, and his interest in the Association, it was moved that E. J. McGrew, Jr., be presented a membership in the American Public Works Association for the year 1938-39. The motion was passed unanimously.

Directors' Travel Expense Proposal

Further consideration was given to the question, which was discussed at the Board meeting on Sunday, October 2, 1938, of paying the traveling expenses to the annual meeting of those members of the Board whose expenses were not paid by their city. The purpose of the discussion was to determine what should be the future policy. While expenses of Board members to special or interim meetings will be paid by the Association, it was the consensus of the Board of Directors that payment of said expenses to the annual meeting should not be established as a policy.

December Board Meeting

It was agreed that the next meeting should be a meeting of the full Board of Directors, to be held in Chicago in December. It was further agreed that this meeting should take place either in the first or second week of the month, preferably the first week.

Special Fund

The Board discussed some complications which have arisen pertaining to the registration of bonds in the special fund and referred the matter to former Treasurer Phillips and Treasurer Paul to straighten out. Mr. Howe explained the background of this situation. Mr. Paul was instructed to report back to the Board of Directors on the status of this matter at its December meeting.

1939 Yearbook Policy

The executive director reviewed the policy, established last year, of extending the scope of the *Public Works Engineers' Yearbook* to include pertinent material in addition to the convention proceedings. Approval was given to the continuation of that policy for future issues of the Yearbook.

Membership Extension in New York

Mr. McGrew expressed the thought that the engineers in the municipal service in New York could contribute to the Association and he volunteered to try to work out a plan to bring in as members some of the local municipal engineers.

Mayor La Guardia Elected Member

In recognition of his stand on the career service principle in government, made in his opening address to the Public Works Congress, Mayor F. H. La Guardia of New York City was unanimously elected a member of the American Public Works Association for the next three years by the Board of Directors.

While expressing his regrets at the ending of his close association with the Board members and the organization, Mr. Buckley, who retired from the Board this year, discussed the excellence of the present policy of rotating the officers of the Association. He stated that he saw great values in this policy and heartily recommended that it be continued.

Mr. Shafer presented the invitation of the City of Pittsburgh to hold the 1939 Public Works Congress there. He stated that Pittsburgh was anxious to have the meeting and he asked that serious consideration be given to this invitation.

Report of Resolutions Committee

W. E. Rosengarten, reporting for the Committee on Resolutions, presented the following resolution which was adopted:

Whereas, The American Public Works Association here assembled in the Hotel Pennsylvania, New York City, has enjoyed a most pleasant and instructive three-day congress, and

Whereas, It desires to show its appreciation for the courtesies extended and the knowledge acquired in the public works field, therefore be it

Resolved, That the American Public Works Association express its heartiest thanks to the Honorable F. H. La Guardia, Mayor of the City of New York, the Local Arrangements Committee headed by Deputy Commissioner E. J. McGrew, Jr., of the Public Works Department, the Ladies Reception Committee under the Chairmanship of Frances Lehrich, Secretary of the Board of Estimate, and all who were instrumental in extending the courtesies of the City, and be it further

Resolved, That the Congress express its appreciation to all who contributed to the technical sessions, by the presentation of papers and discussions which have greatly advanced the field of public works.

Meeting of the Executive Committee

New York, N. Y. *October 5, 1938*

A short meeting of the Executive Committee of the American Public Works Association was held immediately after the annual Board of Directors meeting in New York City, on Wednesday, October 5, 1938. In addition to President Brown, who presided, those present were: J. S. Flockhart, F. T. Paul, F. W. Herring and N. Hebden.

The purpose of this meeting was to select the design of the Association badge.

After examining several designs of a pin submitted by the jeweler, the committee selected design No. 2, directing that several changes be made. The changes are to remove the outer lettering and to provide an enamel fill-in in the center of the pin.

The meeting adjourned at 2:50 P.M.

Meeting of Board of Directors

Chicago, Illinois *November 26, 1938*

THE BOARD of Directors met in Chicago on November 26, 1938 with President Brown in the chair. Those present were Messrs. Phillips, Paul, Galligan, Howe, Rosengarten, Shafer, Lenhardt, and Storrer. Absent were Messrs. Root, Flockhart and Bradley.

The meeting was called to order at 9:50 A.M. The executive director reported on a number of invitations from various cities regarding the 1939 Public Works Congress. It was moved by Mr. Lenhardt and seconded by Mr. Storrer that the convention be held in Pittsburgh on October 2, 3, and 4, or during the preceding or subsequent week, at the decision of the local committee. The motion was carried unanimously.

President Brown appointed William B. Shafer chairman of the local committee.

In connection with the convention, the Board decided that the dance customarily held on the night of the annual banquet be continued at the Pittsburgh meeting. It was also decided that the men's party ordinarily held on Monday evening would be continued, and that it should be made self-supporting through the sale of tickets.

The Board decided that commercial exhibits should be made a feature of the Pittsburgh meeting, and that the sale of exhibit space would be primarily the responsibility of the local committee, with the cooperation of the headquarters office. It was decided that the cost of these exhibits should be underwritten by the Association, and that any profits derived from the sale should revert to the Association. The Board also approved, subject to the desires of the local arrangements committee, the publication of a souvenir program for the convention which would carry advertising. It was understood that any net proceeds derived from either the sale of exhibit space or the sale of advertising in the program, or both, are to be made available for the cost of entertainment at the convention.

The Board determined that the salary of the executive director should be $6,600 for the calendar year 1939 and $7,200 for the calendar year 1940, subject to the approval of the Spelman Fund of the application for a grant for those two years adequate to cover those figures.

The executive director presented a proposed budget for the year 1939. The proposed budget contemplated a substantial increase in activities and a corresponding increase in staff personnel and general office expenditures. This budget was coupled with an application to the Spelman Fund for a grant large enough to make the increased level of activities possible.

An alternate budget was also presented by the executive director which contemplated continuing in 1939 the same level of activities that has characterized 1938. This alternate budget was coupled with an alternate proposal to the Spelman Fund for a grant sufficient in size to make this program possible.

The Board approved both budgets and instructed the executive director to put into effect the appropriate budget upon his hearing from the Spelman Fund as to its action.

The executive director presented a proposed application to the Spelman Fund for the grant for operation in accordance with the two alternate budgets. This application was unanimously approved. The amounts asked for were $27,100 for 1939 and $26,900 for 1940, a total of $54,000 for the expanded program; or $20,100 for 1939 and $20,900 for 1940, a total of $41,000, for a program at the same level as the 1938 program.

The executive director also presented a proposed application to the Spelman Fund for a research grant for the two-year period beginning March 1, 1939. The Board approved the application, which was for $17,000, the same amount as has been available for the research program of the Association during the past two years.

Mr. Howe presented the revised specification for Portland Cement Concrete Pavements and moved that it be approved for publication as a revised standard. The motion was carried unanimously.

Mr. Phillips announced that there was to be a slight revision in the specification for brick pavements, the revision to be forwarded to the headquarters office.

The meeting adjourned at 4:30 P.M.

Constitution of the American Public Works Association

I. NAME

The name of the Association shall be "American Public Works Association," and its principal place of business shall be at Chicago, Illinois.

II. PURPOSES

The purposes of the Association shall be the advancement of the theory and practice of the design, construction, maintenance, administration, and operation of public works facilities and services; the dissemination of information and experience upon and the promotion of improved practices in public works administration; the encouragement of the adherence by public works officials to a high professional standard; and the professional and social improvement of its members.

The Association is not organized for profit, and no part of the earnings shall inure to the benefit of any member or officer, except as compensation for services rendered or for necessary expenses actually incurred.

III. MEMBERS

a. *Active*—Any person holding an elective or appointive position on a public body engaged in the field of public works, or being an officer, executive, staff member or consultant to, or a member of the staff of a consultant to, such a body, shall be eligible for Active membership in the Association.

b. *Associate*—Any person having special knowledge, experience or interest in any phase of public works activity shall be eligible for Associate membership.

c. *Senior*—Any member who shall have paid dues continuously for a period of thirty years in the Association and/or the American Society of Municipal Engineers and/or the International Association of Public Works Officials, or who at the time this constitution becomes effective is enrolled as a Senior member of the American Society of Municipal Engineers or as a Life member of the International Association of Public Works Officials, shall be eligible for Senior membership if he so elects and thereafter shall not be required to pay Association dues.

d. *Honorary*—At the recommendation of the Board of Directors and a two-thirds vote of members present at an annual conference, persons may be elected Honorary members of the Association. Those enrolled as Honorary members in the International Association of Public Works Officials at the time this constitution becomes effective shall be continued as Honorary members of this Association.

Only Active and/or Senior members shall be entitled to hold office.

An Active member who retires from official position shall, unless otherwise ordered by the Board of Directors, be retained in his active status.

IV. BOARD OF DIRECTORS AND EXECUTIVE COMMITTEE

The governing body of the Association shall be the Board of Directors, consisting of:

a. The President, First Vice-President, Second Vice-President, and Treasurer of the Association;

b. The Chairman of the Administration Division;

c. The Chairman of the Maintenance and Operation Division;

d. The Chairman of the Design and Construction Division;

e. Four Active or Senior members of the Association at-large elected at the 1937 annual meeting for terms of one, two, three and four years respectively, whose successors shall be elected for a term of four years;

f. The last living Past-President of the Association;

g. Four members of the American Society of Municipal Engineers elected by the Board of Directors of that organization at the 1936 Public Works Congress to serve from January 1, 1937, until the 1937 annual meeting of the Association;

h. Four members of the International Association of Public Works Officials elected by the Board of Governors of that organization at the 1936 Public Works Congress to serve from January 1, 1937, until the 1937 annual meeting of the Association.

The Board of Directors shall be responsible to the membership for the management of the affairs of the Association, and for the promotion of the Association's purposes. It shall have the power of enacting, by a majority vote, such By-Laws as are necessary for the government of the Association.

An Executive Committee, consisting of the last living Past-President, the President, the First Vice-President, the Second Vice-President, and the Treasurer of the Association, shall have the power to exercise all the functions of the Board of Directors between annual meetings and when the Board is not in session.

In the event of a vacancy upon the Board of Directors, the remaining members of the Board shall have power to elect an Active or Senior member to fill the vacancy, to serve until the next annual meeting of members.

V. OFFICERS

The officers of the Association shall be a President, a First Vice-President, a Second Vice-President, and a Treasurer, who shall be Active and/or Senior members elected by letter ballot of the members of the International Association of Public Works Officials and the American Society of Municipal Engineers to serve from January 1, 1937, until the 1937 annual meeting of the Association, and whose successors shall be Active and/or Senior members elected by the members of the Association at the annual meeting for a term of one year.

The Board of Directors shall select an Executive Director and such employees as they may deem proper, to serve at their pleasure, and shall fix their compensation.

In the event of a vacancy occurring in the office of President, the unexpired term shall be filled by the First Vice-President, to be succeeded by the Second Vice-President. In the event of a vacancy occurring in the office of Treasurer, the Board of Directors shall select an Active or Senior member to fill the unexpired term.

VI. DUTIES OF OFFICERS

a. The President shall act as Chairman of the Board of Directors and of the Executive Committee, and shall preside at meetings of the members, except as otherwise ordered by the Board. He shall appoint such standing or special committees as he shall consider necessary or as instructed by the Board of Directors, and shall be, ex-officio, a member of such committees. He shall be responsible to the Board of Directors for the functioning of these committees. He shall sign on behalf of the Association all deeds, contracts and other formal instruments, and shall perform such other duties as may from time to time be assigned to him by the Board of Directors.

b. The Vice-Presidents shall, during the absence of the President or his inability to act, have and exercise all his powers and duties, and shall also perform such other duties as may from time to time be assigned to them by the Board of Directors.

c. The Treasurer shall be the chief financial agent of the Association, and shall exercise authority in all financial matters in accordance with such by-laws and resolutions as may be adopted by the Board of Directors. The Executive Director shall furnish the Treasurer with such financial statements as he may require. The Treasurer shall have the custody of all funds and securities of the Association, including all bonds, stocks, deeds, and other documents, and to this end he may determine the manner of depositing and safe-keeping of the funds and securities of the Association and the system of financial records. The Board of Directors shall fix the amount of the bond to be furnished by the Treasurer, the cost of such bond to be borne by the Association.

d. The Executive Director shall be in charge of the general management of the affairs of the Association subject to this constitution and such regulations as may be adopted by the Board of Directors. He shall collect all fees and other moneys owing to the Association and shall deposit them to the credit of the Association; he shall annually prepare a budget for the Association and upon its approval by the Board of Directors shall have authority to expend the sums appropriated; he shall keep a complete record of all his receipts and expenditures, which shall annually be audited by a firm of certified public accountants and the report submitted to the Board of Directors; he shall give bond in such form and amount as may be determined by the Board of Directors, the cost of such bond to be borne by the Association. He may appoint and discharge any employees or subordinates, and shall fix their compensation within such limits as may be provided by the budget, and may make agreements on behalf of the Association in performing the duties en-

trusted to him. He shall act as Secretary of the Association, shall conduct its correspondence, shall give notice of and keep minutes of all meetings, and shall have custody of the records of the Association and of the corporate seal, and shall attest all instruments. He shall perform such other duties as may be assigned to him by the President and the Board of Directors.

VII. MEETINGS

An annual meeting of the members of the Association shall be held at a time and place to be determined by the Board of Directors. Special meetings shall be held on the call of the President or the Board of Directors, or upon the request in writing of any one hundred and twenty-five Active and/or Senior members. Such special meetings shall be held within thirty days of the receipt of request. The Board of Directors shall have its annual meeting immediately following the annual meeting of the members. Special meetings of the Board of Directors or of the Executive Committee shall be held on the call of the President or on the request in writing of any three members of the Board or Committee.

At least five days' notice of the time, place, and purpose of all meetings shall be given to all persons entitled to notice thereof. Such notice may be given by mail or telegram to the last known address of the person, or personally.

VIII. QUORUM

A majority of the Board of Directors shall constitute a quorum thereof. A quorum of the Executive Committee shall be three members. Twenty members shall constitute a quorum to do business at a meeting of members.

IX. DUES

The annual dues for Active and Associate members shall be as determined from time to time by the Board of Directors, subject to the approval of the membership. Non-payment of dues for two years shall be treated as equivalent to resignation, unless otherwise provided by the Board of Directors, and the name of the member shall be removed from the rolls of the Association, provided at least four weeks' notice is given, during which time he may discharge his obligations and have his membership continued.

X. NOMINATIONS

A Nominating Committee, composed of two members of the International Association of Public Works Officials selected by the Board of Governors of that organization at the 1936 Public Works Congress and two members of the American Society of Municipal Engineers selected by the Board of Directors of that organization at the 1936 Public Works Congress, shall propose the names of candidates for Presi-

dent, First Vice-President, Second Vice-President, and Treasurer to serve from January 1, 1937, until the 1937 annual meeting.

The President, with the approval of the Board of Directors, shall thereafter appoint each year a Nominating Committee of five Active and/or Senior members, which shall propose the names of candidates for all officers and directors-at-large to be voted upon at the annual meeting. Additional nominations may be made from the floor at the annual meeting by any Active member.

XI. DIVISIONS

There shall be three Divisions to provide for the specialized interests of the members of the Association: The Administrative Division, the Design and Construction Division, and the Maintenance and Operation Division. A member of the Association may register in any one or more of the Divisions. Each Division shall be presided over by a Chairman, who shall be elected at the annual meeting by the members registered in that Division. The same person shall not serve as Chairman continuously of the same Division in excess of two years.

The three Divisions shall be managed in conformity with the constitution of the Association and the rules established by the Board of Directors.

XII. CHAPTERS

The Association shall encourage and recognize the establishment of regional, state and local chapters of its members, the purposes of which shall be the furtherance of the objectives of the Association in the region, state or locality. Applications for the establishment of a chapter, together with a copy of the proposed chapter by-laws and a list of those who have agreed to become members of the chapter, shall be submitted to the Board of Directors for approval. Upon notice of approval given by the Board, the chapter shall be considered established.

All chapters shall be managed in conformity with the constitution of the Association and the rules established by the Board of Directors.

XIII. SEAL

The Association shall have a seal which shall bear the legend "American Public Works Association," and the year of incorporation.

XIV. WAIVER OF NOTICE AND ACTION WITHOUT MEETING

Any person entitled to vote at any meeting of members, or of the Board of Directors, or of the Executive Committee, may waive notice of the time, place, and purpose of such meeting either before or after the date of such meeting, and any action taken or resolution adopted thereat shall, upon such waiver, be as valid as though notice had been given.

Any action or resolution which might be taken or adopted at any

meeting of the Board of Directors, Executive Committee, or members, shall be valid if written memorandum of such action or resolution is duly served upon all persons entitled to vote thereon in the manner prescribed for notice of a meeting, and if such action or resolution is approved in writing by a majority of the persons entitled to vote thereon.

XV. AMENDMENTS

Proposed amendments to this constitution must be submitted to the Board of Directors in writing, signed by not less than twenty-five Active and/or Senior members. If the proposed amendment is approved by the Board of Directors, it shall be submitted to the membership for letter ballot. An affirmative vote of two-thirds of the qualified votes cast shall be necessary for the adoption of a proposed amendment.

Association Committees*

COMMITTEE ON CITY AND REGIONAL PLANNING

FREDRICK R. STORRER, *Chairman,* City Engineer, Municipal Bldg., Dearborn, Mich.
PIERRE BOUCHER, Secretary, Montreal Metropolitan Commission, Department of Planning & Research, 10 St. James St., W. Montreal, Can.
THOMAS BUCKLEY, Assistant Chief Engineer and Surveyor, Bureau of Engineering, Surveys and Zoning, 1102 City Hall Annex, Philadelphia, Pa.
ARTHUR W. CONSOER, General Manager, Consoer, Townsend & Quinlan, 211 W. Wacker Dr., Chicago, Ill.
A. J. HAWKINS, Civil Engineer, 4020 Ninth Court, South, Birmingham, Ala.
WALTER A. HEIMBUECHER, City Engineer, City Hall, University City, Mo.
S. C. JACKA, City Engineer, City Hall, Lansing, Mich.
W. E. SHEDDAN, City Engineer, City Engineers' Bldg., Jacksonville, Fla.

COMMITTEE ON FIELD ENGINEERING

WALTER STARKWEATHER, *Chairman,* Division Civil Engineer, U.S. Coast Guard, Seattle Division, National Bldg., Seattle, Wash.
LLOYD ALDRICH, City Engineer, 600 City Hall, Los Angeles, Calif.
HERBERT M. DIBERT, Secretary and Treasurer, W. & L. E. Gurley, 514 Fulton St., Troy, N. Y.
FREDERICK THOMAS THORPE, JR., Surveyor and Regulator, 1129 Sanger St., Frankford, Philadelphia, Pa.
B. B. WEBER, City Engineer, City Bldg., Oil City, Pa.

COMMITTEE ON STREET PAVING, CONSTRUCTION DESIGN AND MAINTENANCE

GEORGE H. SANDENBURGH, *Chairman,* City Engineer, City Hall, Ann Arbor, Mich.
ARVID ANTON ANDERSON, Manager, Highways and Municipal Bureau, Portland Cement Assn., 33 W. Grand Ave., Chicago, Ill.
ROBERT B. BROOKS, Consulting Engineer, 1517 Mart Bldg., St. Louis, Mo.
GEORGE BYRUM, JR., Street Commissioner, 401 City Hall, Birmingham, Ala.
WALTER N. FRICKSTAD, City Engineer, 803 City Hall, Oakland, Calif.
PREVOST HUBBARD, Chemical Engineer, The Asphalt Institute, 801 Second Ave., New York, N. Y.
E. L. KNEBES, Assistant City Engineer, 407 City Hall, Milwaukee, Wis.

* As appointed January, 1939.

George H. Ruhling, Municipal Engineer on Design and Maintenance, State Highway Dept., Lansing, Mich.

George F. Schlesinger, Chief Engineer and Managing Director, National Paving Brick Assn., National Press Bldg., Washington, D. C.

William B. Shafer, Superintendent of Highways and Sewers, City-County Bldg., Pittsburgh, Pa.

Hugh W. Skidmore, Director, Chicago Testing Laboratory, Inc., 536 Lake Shore Dr., Chicago, Ill.

Nathan L. Smith, Chief Engineer, Maryland State Roads Commission, Federal Reserve Bank Bldg., Baltimore, Md.

COMMITTEE ON PUBLIC LIGHTING

Sanford C. Lovett, *Chairman,* Superintendent of Lights, Bureau of Engineering, 445 City-County Bldg., Pittsburgh, Pa.

W. T. Blackwell, General Lighting Representative, Public Service Electric & Gas Co., 80 Park Place, Newark, N. J.

Ellsworth Francisco, Engineer in Charge, Bureau of Lighting, City Hall, Newark, N. J.

John F. Gallagher, Accident Analysis Engineer, Division of Traffic Engineering, Dept. of Public Safety, 631 City Hall, Philadelphia, Pa.

Paul Homer Goodell, Managing Engineer, General Illumination Engineering Co., 3605-07 Carew Tower, Cincinnati, Ohio

Anton Pav, Commissioner of Public Works, 6307 W. Cermak Rd., Berwyn, Ill.

Kirk M. Reid, Illuminating Engineer, Nela Park Engineering Dept., General Electric Co., Cleveland, Ohio

Samuel H. Strickland, Director of Public Works, High Point, N. C.

Peter J. Stupka, Traffic Engr., Div. of Professional & Service Projects, WPA, Auditorium, 19th & E Sts., Washington, D. C.

Arthur L. Wichner, Superintendent of Public Works, City Hall, West Allis, Wis.

Stuart R. Williams, Manager, Street Lighting Department, Holophane Co., Newark, Ohio

L. A. S. Wood, Chief Lighting Engineer, Westinghouse Electric & Mfg. Co., 1216 W. 58th St., Cleveland, Ohio

COMMITTEE ON TRAFFIC CONTROL

Burton W. Marsh, *Chairman,* Director, Safety and Traffic Engineering Dept., American Automobile Assn., Pennsylvania Ave. at 17th St., Washington, D. C.

Lewis V. Bullis, Traffic Engineer, Works Progress Administration, 1900 F St., N. W., Washington, D. C.

John H. Hunter, II, Traffic Signal Engineer, Division of Traffic Engineering, 790 City Hall, Philadelphia, Pa.

EDWIN F. KOESTER, Survey and Traffic Engineer, 414 W. 22nd St., Wilmington, Del.

FRANK J. McDEVITT, Director, Streets and Sewers, City Hall, St. Louis, Mo.

THEODORE M. MATSON, Research Associate, Bureau for Street Traffic Research, 315 Strathcona Hall, Yale University, New Haven, Conn.

D. GRANT MICKLE, Manager, Traffic and Transport Dept., Jensen, Bowen & Farrell, and Assistant Director, Michigan Highway Planning Survey, Michigan Theatre Bldg., Ann Arbor, Mich.

ROBERT A. MITCHELL, Traffic Engineer, Dept. of Public Safety, 790 City Hall, Philadelphia, Pa.

A. J. NAQUIN, Superintendent of Schedules, New Orleans Public Service, Inc., 317 Baronne St., New Orleans, La.

COMMITTEE ON STREET CLEANING

WILLIAM ALBERT XANTEN, *Chairman,* Supervisor, City Refuse Division, Engineering Dept., District Bldg., Washington, D. C.

LEO P. GALLEN, Assistant Engineer, Bureau of Highways and Street Cleaning, 924 City Hall Annex, Philadelphia, Pa.

WILLIAM J. GALLIGAN, Division Superintendent, Bureau of Streets, 2840 S. Calumet Ave., Chicago, Ill.

HARRY GOODRIDGE, City Engineer and Superintendent of Streets, City Hall, Berkeley, Calif.

H. W. JOHNSTON, City Engineer, City Hall, Halifax, Nova Scotia, Can.

G. E. TAYLOR, Deputy Street Commissioner, 90 Albert St., Toronto, Ontario.

N. M. ULSCH, Assistant Superintendent, Street Cleaning Department, 5th and Cleveland St., Jacksonville, Fla.

WILBUR H. WINSHIP, Assistant Superintendent, Dept. of Sanitation, 1020 Sanders St., Indianapolis, Ind.

COMMITTEE ON SEWERAGE AND SEWAGE DISPOSAL

ALBERT P. LEARNED, *Chairman,* Assistant Engineer, Black and Veatch, 4706 Broadway, Kansas City, Mo.

CARL B. CARPENTER, Assistant Engineer, Charles Hurd Co., Hammond, Ind.

MORRIS M. COHN, Sanitary Engineer, City Hall, Schenectady, N. Y.

WILLIAM C. EMIGH, City Engineer, City Hall, Coatesville, Pa.

JAMES L. FEREBEE, Chief Engineer and Manager City Sewerage Comm., Box 2079, Milwaukee, Wis.

JOHN B. HAWLEY, Consulting Civil Engineer, 407 Capps Bldg., Fort Worth, Tex.

CLARENCE E. KEEFER, Principal Assistant to Sewerage Engineer, 1918 Mt. Royal Terrace, Baltimore, Md.

P. W. Maetzel, City Engineer, City Hall, Columbus, Ohio

William M. Piatt, Consulting Engineer, 111 Corcoran Street Bldg., Durham, N. C.

Thorndike Saville, Dean and Professor of Hydraulic Sanitary Engineering, New York University, Box 65, University Heights, New York, N. Y.

Darwin W. Townsend, *Chairman,* Consulting Engineer, Consoer, Townsend and Quinlan, 839 N. Marshall St., Milwaukee, Wis.

Abel Wolman, Chairman, National Water Resources Committee, Professor of Sanitary Engineering, Johns Hopkins University, Homewood, Baltimore, Md.

COMMITTEE ON REFUSE COLLECTION AND DISPOSAL

Stuart M. Weaver, *Chairman,* Executive Assistant to Director of Public Works, and Superintendent of Water Bureau, City Hall, Montclair, N. J.

H. J. Cates, Chief, Sanitary Department, 603 City Hall, Atlanta, Ga.

David W. Godat, Maintenance Engineer, Dept. of Public Property, 18 City Hall, New Orleans, La.

John V. Lewis, Director of Maintenance and Operation, Dept. of Public Works, 54 Court St., Rochester, N. Y.

Carl Schneider, Consulting Engineer, 7711 Plum St., New Orleans, La.

William B. Shafer, Superintendent of Highways and Sewers, City-County Bldg., Pittsburgh, Pa.

Ralph C. Taylor, Superintendent, Waste Collection Division, 350 City Hall, Cincinnati, Ohio

Jean L. Vincenz, Commissioner Public Works and City Engineer, City Hall, Fresno, Calif.

COMMITTEE ON WATER WORKS

Joseph P. Schwada, *Chairman,* City Engineer, City Hall, Milwaukee, Wis.

J. R. Baylis, Physical Chemist, Bureau of Engineering, 6843 Oglesby Avenue, Chicago, Ill.

D. L. Erickson, Director of Parks, Public Property and Improvements, City Hall, Lincoln, Nebr.

Loran G. Gayton, City Engineer, City Hall, Chicago, Ill.

L. R. Howson, Consulting Engineer, Alvord, Burdick & Howson, 20 N. Wacker Drive, Chicago, Ill.

Laurence G. Lenhardt, Superintendent and General Manager, Board of Water Commissioners, 506 Water Board Bldg., Detroit, Mich.

Frederick Ohrt, Manager and Chief Engineer, Board of Water Supply, P. O. Box 3347, Honolulu, T. H.

Walter A. Peirce, Manager, Water Dept., City Hall, Racine, Wis.

Wesley W. Polk, Commissioner of Public Works and Superintendent Water Works, City Hall, Evanston, Ill.

George N. Schoonmaker, Chief Engineer, Lake Erie Water Supply Project, 110 Cherry St., Toledo, Ohio
Leon A. Smith, Superintendent, Water Works, City Hall, Madison, Wis.
William Sydow, Consulting Engineer, 3461 Main Highway, Miami, Fla.
J. D. Webb, City Engineer, City Hall, Birmingham, Ala.

COMMITTEE ON PUBLIC UTILITIES

Robert B. Brooks, Consulting Engineer, and Member, Missouri State Highway Commission, 1517 Mart Bldg., St. Louis, Mo.
John Campbell, Consulting Engineer, 8 Euclid Ave., Boston, Mass.
Fred A. Earhart, Commissioner of Public Utilities, City Hall, New Orleans, La.
Edgar B. Hess, Civil Engineer, 183 Plum St., Chillicothe, Ohio
Albert P. Learned, Assistant Engineer, Black & Veatch, 4706 Broadway, Kansas City, Mo.
T. Fred Older, Manager of Public Utilities, 125 W. Michigan Ave., Ypsilanti, Mich.
Alfred E. Roche, Division Engineer, Works Progress Administration, 74 Chapel Street, Albany, N. Y.
Walter A. Shaw, Consulting Engineer, 30 N. LaSalle St., Chicago, Ill.

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Robert S. Hedtler, *Chairman,* Consulting Engineer for Aeronautics, 1420 21st St., N. W., Washington, D. C.
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Harry Goodridge, City Engineer and Superintendent of Streets, City Hall, Berkeley, Calif.
W. W. Horner, Municipal and Sanitary Consulting Engineer, 1312 International Office Bldg., St. Louis, Mo.
Cornelius W. Phillips, Superintendent, Dept. of Streets and Engineering, 36 Court St., Springfield, Mass.
W. H. Roberts, Commissioner of Public Works, City Hall Annex, Rochester, N. Y.
Howard M. Shafer, Airport Manager, Department of Commerce, 34 Court St., Rochester, N. Y.

SPECIFICATIONS COMMITTEE ON SEWERS

Edwin R. Schofield, *Chairman,* Division Engineer, Bureau of Engineering, Surveys and Zoning, 616 E. Leverington Ave., Philadelphia, Pa.
H. Walter Hughes, Supervisor, Section Tests and Materials, Dept. of Public Works, City Hall, Rochester, New York
Mervin H. Kohler, Assistant Engineer, Bureau of Engineering, Surveys and Zoning, City Hall Annex, Philadelphia, Pa.

M. W. Loving, Secretary, American Concrete Pipe Assn., 33 W. Grand Ave., Chicago, Ill.

Marion C. Patton, Chief Engineer, Armco Culvert Manufacturers Association, 701 Curtis St., Middletown, Ohio

Robert G. Scott, Vice President and Consulting Engineer, Clay Products Assn., 111 W. Washington St., Chicago, Ill.

G. R. Thompson, City Engineer, City Hall, Detroit, Mich.

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H. E. Barnes, City Engineer, City Hall, Shreveport, La.

W. D. Beers, City Engineer, 401 City and County Bldg., Salt Lake City, Utah

Harry Goodridge, City Engineer and Superintendent of Streets, City Hall, Berkeley, Calif.

William A. Hansell, Assistant Chief of Construction and Engineer of Sewers, 737 Woodland Ave., S. E., Atlanta, Ga.

George E. Hesselbacher, Township Engineer, 8200 Fairview Rd., Elkins Park, Pa.

J. E. Pennybacker, Managing Director, The Asphalt Institute, 801 Second Ave., New York, N. Y.

George C. Stanley, City Engineer and Superintendent of Streets, City Hall, Burlington, Vt.

Lewis M. Wrenn, City Engineer, City Hall, Pontiac, Mich.

SPECIFICATIONS COMMITTEE ON BITUMINOUS PAVEMENTS

H. F. Clemmer, *Chairman,* Engineer of Materials, District Bldg., Washington, D. C.

Julius Adler, Consulting Engineer, 2001 Architects Bldg., 17th and Sansom Sts., Philadelphia, Pa.

George W. Andress, Engineer in Charge, Bureau of Streets, City Hall, Newark, N. J.

William Ernest Baldry, City Engineer, 1206 W. 13th St., Topeka, Kans.

A. W. Dow, Vice-President and Chief Engineer, Colprovia Roads, Inc., 801 Second Ave., New York, N. Y.

John B. Hoke, District Engineer, Interstate Amiesite Co., P. O. Box 676, Martinsburg, W. Va.

Prevost Hubbard, Chemical Engineer, Asphalt Institute, 801 Second Ave., New York, N. Y.

H. WALTER HUGHES, Supervisor, Section Tests and Materials, 34 Court St., Rochester, N. Y.

H. J. LOVE, Manager, National Slag Assn., 644 Earle Bldg., Washington, D. C.

GEORGE E. MARTIN, Consulting Engineer, The Barrett Co., 40 Rector St., New York, N. Y.

STANTON WALKER, Director of Engineering, National Sand and Gravel Assn., Munsey Bldg., Washington, D. C.

SPECIFICATIONS COMMITTEE ON BRICK PAVEMENTS

ROY L. PHILLIPS, *Chairman,* City Engineer, City Bldg., Meadville, Pa.

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A. MASON HARRIS, Chief, Bureau of Streets, Department of Public Works, 217 Governor St., Richmond, Va.

W. L. HEMPELMANN, Engineer, Asphalt Sales Dept., The Texas Co., 332 S. Michigan Ave., Chicago, Ill.

LYONS MUSSINA, City Engineer, City Hall, Williamsport, Pa.

WILLIAM C. PERKINS, Chief Engineer, Eastern Paving Brick Assn., Langhorne, Pa.

GEORGE F. SCHLESINGER, Chief Engineer and Managing Director, National Paving Brick Assn., National Press Bldg., Washington, D. C.

H. LEE WILSON, City Engineer, City Hall, Johnstown, Pa.

SPECIFICATIONS COMMITTEE ON CEMENT CONCRETE PAVEMENTS

HENRY L. HOWE, *Chairman,* City Engineer, City Hall, Rochester, N. Y.

ARVID ANTON ANDERSON, Manager, Highways and Municipal Bureau, Portland Cement Assn., 33 W. Grand Ave., Chicago, Ill.

WALTER F. HICKS, City Engineer, City Hall, Paris, Tex.

HARVEY HINCKS, City Engineer, and Superintendent of Streets, 211 City Hall, Pasadena, Calif.

IRVING HOCHSTADTER, President and Technical Director, Stillman & Van Siclen, Inc., 254 W. 31st St., New York, N. Y.

ELMER W. HOPKINS, City Engineer, City Hall, Salina, Kans.

EDWARD M. HUNT, Commissioner of Public Works, City Engineer, City Hall, Portland, Me.

OLIVER L. KING, Township Engineer and Building Inspector, Township Building, Abington, Pa.

MONROE L. PATZIG, Consulting Engineer, Patzig Testing Laboratories, 2215 Ingersoll Ave., Des Moines, Iowa

W. E. SHEDDAN, City Engineer, City Engineers' Bldg., Jacksonville, Fla.

STANTON WALKER, Director of Engineering, National Sand and Gravel Assn., Munsey Bldg., Washington, D. C.

SPECIFICATIONS COMMITTEE ON STABILIZED ROADS FOR MUNICIPALITIES

H. F. Clemmer, *Chairman,* Engineer of Materials, District Bldg., Washington, D. C.

John Ames, City Manager, City Hall, Ames, Iowa

A. T. Goldbeck, National Crushed Stone Association, Munsey Bldg., Washington, D. C.

H. J. Love, Manager, National Slag Association, 644 Earle Bldg., Washington, D. C.

E. W. Meckley, City Engineer, City Hall, Allentown, Pa.

George Oldham, 1226 16th Avenue S., Nashville, Tenn.

Stanton Walker, Director of Engineering, National Sand and Gravel Assn., Munsey Bldg., Washington, D. C.

SPECIFICATIONS COMMITTEE ON STREET RAILWAY PAVEMENTS AND TRACK CONSTRUCTION

C. L. Hawkins, *Chairman,* Superintendent, Maintenance of Way, St. Louis Public Service Co., 3869 Park Ave., St. Louis, Mo.

E. A. Fisher, City Engineer, City Hall, Lakewood, Ohio

Albert H. Guillot, Roadway Engineer, New Orleans Public Service, Inc., 1423 Adams St., New Orleans, La.

R. C. Harris, Commissioner of Works, City Hall, Toronto, Ontario, Can.

John L. Martin, Engineer of Way, Philadelphia Rapid Transit Company, 820 W. Dauphin St., Philadelphia, Pa.

Alfred E. Roche, Division Engineer, Works Progress Administration, 74 Chapel St., Albany, N. Y.

SPECIFICATIONS COMMITTEE ON SIDEWALKS AND CURBS

Thomas E. Collins, *Chairman,* City Engineer, City Hall, Elizabeth, N. J.

M. D. Jackson, City Engineer, 620 N. Clark St., Stevens Point, Wis.

Anton J. Krupicka, Commissioner, Dept. of Public Works, 5520 W. Cermak Rd., Cicero, Ill.

John M. Powell, City Engineer, City Hall, Elyria, Ohio

Lawrence C. Whitsit, City Engineer, 30 Gerald Ave., Highland Park, Mich.

Howard C. Young, 10 Genesee Parkway, Cuba, N. Y.

PUBLICATIONS COMMITTEE

W. W. DeBerard, Associate Editor, "Engineering News-Record," 520 N. Michigan Ave., Chicago, Ill.

Clarence E. Ridley, Executive Director, International City Managers' Association, 1313 E. 60th St., Chicago, Ill.

SPECIAL FUND COMMITTEE

THOMAS BUCKLEY, *Chairman,* Assistant Chief Engineer and Surveyor, Bureau of Engineering, Surveys and Zoning, 1102 City Hall Annex, Philadelphia, Pa.

W. W. DEBERARD, Associate Editor, "Engineering News-Record," 520 N. Michigan Ave., Chicago, Ill.

HARRISON P. EDDY, JR., Consulting Engineer, Metcalf & Eddy, Statler Bldg., Boston, Mass.

LESTER W. HERZOG, State Administrator, Works Progress Administration, Old Post Office Bldg., Albany, N. Y.

J. EUGENE ROOT, Director of Public Works, City Hall, Cincinnati, Ohio

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P. L. BROCKWAY, *Chairman,* City Engineer, City Hall, Wichita, Kans.

A. PRESCOTT FOLWELL, Editor, "Public Works," 310 E. 45th St., New York, N. Y.

E. S. RANKIN, Division Engineer, Division of Sewers, City Hall, Newark, N. J.

C. W. S. SAMMELMAN, Secretary, Engineers' Club of St. Louis, 4359 Lindell Blvd., St. Louis, Mo.

REPRESENTATIVES IN OTHER ORGANIZATIONS

AMERICAN SOCIETY FOR TESTING MATERIALS

Committee D-4 on Road and Paving Materials.........JULIUS ADLER
Committee C-4 on Clay and Cement Sewer Pipe........E. S. RANKIN
Committee C-6 on Drain Pipe Specifications (Sectional Com. A6—1925 A. S. A.)....................................E. S. RANKIN
Committee C-13 on Concrete Pipe....................E. S. RANKIN
Committee C-9 on Concrete and Concrete Aggregates....JULIUS ADLER
Committee C-3 on Brick............... ....ROY L. PHILLIPS
Committee C-1 on Portland Cement, Specifications and Tests for (Sectional Com. A1—1928, A. S. A.).............E. W. MECKLEY

NATIONAL RESEARCH COUNCIL

Advisory Board on Highway Research...............W. W. HORNER
Committee on Design............................W. W. HORNER

U. S. DEPARTMENT OF COMMERCE, DIVISION OF SIMPLIFIED PRACTICE

Paving Brick Committee..........................ROY L. PHILLIPS
Committee on Grades of Asphalt.......................A. W. DOW
Committee on Coarse Aggregates..................HENRY L. HOWE

AMERICAN STANDARDS ASSOCIATION

Committee on Road Materials (Sectional Com. A-37)...JULIUS ADLER
Conference on Proposed Code of Good Practice for Brick Masonry

Work (Sectional Com. A-41) .... Roy L. Phillips
Committee on Safety Code for Grandstands (Sectional Committee Z20) .... Laurence G. Lenhardt
Committee on Administrative Requirements for Building Codes—A55 .... B. L. Crozier

AMERICAN ROAD BUILDERS' ASSOCIATION

Committee on Safe Highways .... H. B. Bleck

AMERICAN SOCIETY OF CIVIL ENGINEERS

Committee on Municipal Cleansing .... Samuel A. Greeley
Committee on Street Pavement Economics .... P. L. Brockway

Board of Directors

GUY BROWN, *President,* Engineer, Sewer Design, City Hall, St. Louis, Mo.

JOHN S. FLOCKHART, *1st Vice-President,* Principal Assistant Engineer, Bureau of Street Cleaning, City Hall, Newark, N. J.

ROY L. PHILLIPS, *2nd Vice-President,* City Engineer, City Building, Meadville, Pa.

FREDERICK T. PAUL, *Treasurer,* City Engineer, City Hall, Minneapolis, Minn.

HAROLD D. BRADLEY, Street Commissioner, 90 Albert Street, Toronto, Ontario, Can.

WILLIAM J. GALLIGAN, Division Superintendent, Bureau of Streets, 2840 South Calumet Avenue, Chicago, Ill.

FRANK W. HERRING, Executive Director, 1313 East 60th Street, Chicago, Ill.

HENRY L. HOWE, City Engineer, City Hall, Rochester, N. Y.

LAURENCE G. LENHARDT, Superintendent and General Manager, Board of Water Commissioners, 506 Water Board Bldg., Detroit, Mich.

J. EUGENE ROOT, Director of Public Works, City Hall, Cincinnati, Ohio

WALTER E. ROSENGARTEN, Lower Merion Township Engineer, Township Building, Ardmore, Pa.

WILLIAM B. SHAFER, Superintendent of Highways and Sewers, City-County Bldg., Pittsburgh, Pa.

FREDRICK R. STORRER, City Engineer, Municipal Bldg., Dearborn, Mich.

Alphabetical Roster of Members

The following alphabetical list contains the names of all the members of the American Public Works Association. The date in parentheses indicates the year of member's affiliation. The membership classification is Active unless Associate (Assoc.), Senior, Life, or Honorary membership is indicated.

Abbot, Munro L. (1931) Surveyor & Regulator, 6th District, Bureau of Eng., Surveys & Zoning, 931 W. Lehigh Ave., Philadelphia, Pa.

Adler, Julius (1920) Cons. Engr., 2001 Architects Bldg., 17th & Sansom Sts., Philadelphia, Pa.

Ahrens, Herman F. (Jr.) (Assoc.-1921) Treas., Lock Joint Pipe Co., P. O. Box 21, Ampere, N. J.

Aldrich, Lloyd (1937) City Engr., 600 City Hall, Los Angeles, Calif.

Aldridge, William (1912) Asst. City Engr., 333 McGee St., Winnipeg, Manitoba, Can.

Alexander, Henry F. (1932) City Engr., 366 Oberlin Ave., Lorain, Ohio.

Aloff, Abraham M. (1933) Civil Service Examiner, Room 152, State House, Boston, Mass.

Anderson, A. M. (Life-1920) Vice-Pres. & Treas., Elgin Corp., 100 N. LaSalle St., Chicago, Ill.

Anderson, Albert S. (1932) Asst. Supt. of Distribution, 317 Baronne St., New Orleans, La.

Anderson, Arvid Anton (1936) Mgr., Highways & Municipal Bureau, Portland Cement Assn., 33 W. Grand Ave., Chicago, Ill.

Anderson, Robert L. (1935) Supt. of Public Works, Village Hall, Winnetka, Ill.

Andress, George W. (1921) Engr. in Charge, Bureau of Sts., City Hall, Newark, N. J.

Aronson, A. V. (1938) City Engr., City Hall, Escanaba, Mich.

Austin-Western Road Machinery Co. (Assoc.-1921) 601 Farnsworth Ave., Aurora, Ill.

Ayres, Louis Evans (1928) Ayres, Lewis, Norris & May, 506 Wolverine Bldg., Ann Arbor, Mich.

Bachmann, Frank (1932) Mgr., Sanitary Eng. Division, The Dorr Co., 570 Lexington Ave., New York, N.Y.

Baechlin, Ernest (1916) Civil Engr., 35 Lackawanna Place, Bloomfield, N. J.

Baker, Jacob (1935) Pres., United Federal Workers of America, 532 17th St., Washington, D. C.

Baldry, William Ernest (1918) City Engr., 1206 W. 13th St., Topeka, Kans.

Ballantyne, George H. (1928) Comr. of Public Works, 208 City Hall, Syracuse, N. Y.

Ballo, Alfred (Dr.) (Honorary-1935) Director, Dept. of Public Cleansing, Budapest, Hungary.

Barbour, Frank A. (1914) Cons. Engr., 1119 Tremont Bldg., Boston, Mass.

Bareuther, Charles A. (1932) Engr. Examiner, Civil Service Com., 975 City Hall, Philadelphia, Pa.

Barnes, H. E. (1920) City Engr., City Hall, Shreveport, La.

Barr, Warren L. (1938) Secy.-Treas., Metropolitan Paving Brick Co., Canton, Ohio.

Barrett, Andrew E. (1931) Construction, Technical, Consulting & Designing Engr., Busman Mfg. Co., 4355 Forest Park Blvd., St. Louis, Mo.

Bartow, Edward (1920) Prof., Head of Dept. of Chemistry & Chemical Eng., State University of Iowa, Iowa City, Iowa.

Baxter, Samuel S. (1931) Asst. Engr., Bureau of Eng., Surveys & Zoning, 5221 Horrocks St., Philadelphia, Pa.

Baylis, J. R. (1911) Physical Chemist, Bureau of Eng., 1643 E. 86th St., Chicago, Ill.

Beacham, J. G. (1932) Supt. Water Works, City Engr., City Hall, Athens, Ga.

Bean, Ormond R. (1937) City Comr., 414 City Hall, Portland, Ore.

Berry, Benjamin L. (1930) 2130 N. 18th St., Philadelphia, Pa.

Berry, William C. (1931) Cons. Engr., 20 S. Central Ave., Clayton, Mo.

Beyster, Henry E. (1939) Comr. Public Works, City Hall, Detroit, Mich.

Bieker, Lawrence W. (Assoc.-1937) Structural Engr., The Graver Corp., East Chicago, Ind.

Biery, John M. (1936) City Engr., City Offices, Jackson, Mich.

Biggins, J. C. (1932) City Mgr., City Hall, Newport News, Va.

Bigler, Hugh P. (1932) Director, Rail Steel Bar Assn., 228 N. LaSalle St., Chicago, Ill.

Billingsley, Frederic N. (1929) Cons. Engr., Billingsley Eng. Co., Interstate Bank Bldg., New Orleans, La.

Bird, Byron (1932) Senior Engr., War Dept., 1673 Columbia Rd., N.W., Washington, D. C.

Biser, D. Benton (1930) Director & Secy., Com. on Governmental Efficiency & Economy, Inc., Mercantile Trust Bldg., Baltimore, Md.

Blackwell, W. T. (1923) General Lighting Rep., Public Service Electric & Gas Co., 80 Park Place, Newark, N. J.

Blanchard, Arthur H. (1909) Cons. Highway Engr. & Traffic Control & Transport Consultant, Box C, Edgewood Station, Providence, R. I.

Bleck, H. B. (1928) City Engr. & Supt. of Water Works, City Hall, Waukegan, Ill.

Bloss, Erwin E. (1931) 1312 International Office Bldg., St. Louis, Mo.

Boatrite, James E. (1929) Structural Engr., 4632 Greene St., Germantown, Philadelphia, Pa.

Bogardus, Theodore S. (1929) Asst. City Engr., City Hall, Meadville, Pa.

Boley, Arthur L. (1931) City Engr., City Hall, Sheboygan, Wis.

Boniface, Arthur (1937) Village Engr. & Mgr., P. O. Box 67, Scarsdale, N. Y.

Booz, Louis P. (1928) Cons. Engr., 263 Madison Ave., Perth Amboy, N. J.

Boucher, Pierre (1937) Secy., Dept. of Planning & Research, Montreal Metropolitan Com., 10 St. James St., W., Montreal, Can.

Bouffard, L. J. (Assoc.-1932) Vice-President & General Mgr., Universal Testing Lab. Co., 506 Keystone Bldg., Pittsburgh, Pa.

Bradley, Harold D. (1926) Street Comr., 90 Albert St., Toronto 2, Ontario, Can.

Bradley, James C. (1938) Asst. Supervisor, City Refuse, District Bldg., Washington, D. C.

Bragstad, R. E. (1937) City Engr., City Hall, Sioux Falls, S. Dak.

Brennan, W. C. (Senior-1909) Pres., Brennan Paving Co., Ltd., 400 Gage Ave., North, Hamilton, Ontario, Can.

Brewster, Peter (1938) Director of Public Works, 18 City Hall, Bridgeport, Conn.

Briggs, John (Jr.) (1932) 4736 Large St., Philadelphia, Pa.

Brockway, P. L. (1918) City Engr., City Hall, Wichita, Kans.

Brokaw, Arthur (1935) Town Engr., 853 Kearny Ave., Kearny, N. J.

Brokaw, Charles E. (1935) Supt., Highway Maintenance Division, City Hall, Cincinnati, Ohio.

Brooks, Ernest R. (1931) Surveyor, Bureau of Eng., Surveys & Zoning, 931 W. Lehigh Ave., Philadelphia, Pa.

Brooks, Robert B. (1925) Cons. Engr., & Member, Mo. State Highway Com., 1517 Mart Bldg., St. Louis, Mo.

Brown, Charles Carroll (Senior-1895) Cons. Engr., Hibiscus Rd., Rt. 2, Gainesville, Fla.

Brown, George R. (Assoc.-1933) Brown & Root, Inc., 4300 Calhoun Rd., Houston, Tex.

Brown, Guy (Life-1920) Engr., Sewer Design, City Hall, St. Louis, Mo.

Brown, James F. (1933) 1624 Chew St., Allentown, Pa.

Brown, Prescott G. (1936) Senior Partner, Mason L. Brown & Sons, Civil Engrs., 120 Madison Ave., Detroit, Mich.

Browne, Floyd G. (1936) Sanitary Engr., Box 134, Marion, Ohio.

Brumbaugh, W. Vernon (Assoc.-1927) Secy., National Lime Assn., 927—15th St., N. W., Washington, D. C.

Bryan, Hiram E. (1937) Asst. Engr., City Map Survey, Division of Eng., 242 City Hall Annex, Rochester, N. Y.

Buckley, Thomas (1929) Asst. Chief Engr. & Surveyor, Bureau of Eng., Surveys & Zoning, 1102 City Hall Annex, Philadelphia, Pa.

Buente, C. F. (Assoc.-1926) Concrete Products Company of America, Diamond Bank Bldg., Pittsburgh, Pa.

Bullis, Lewis V. (1932) Traffic Engr., WPA, 1900 F St., N. W., Washington, D. C.

Butler, Joseph J. (1930) Supt., Bureau of Streets, 408 City Hall, Chicago, Ill.

Butterfield, Elmore E. (1921) Chemist, Inventor, 70-04 Dartmouth St., Forest Hills, N. Y.

Button, Joseph T. (1937) Resident Engr. & Inspector, Box 586, Rhinelander, Wis.

Byrum, George R. (Jr.) (1935) Street Com., 401 City Hall, Birmingham, Ala.

Cahill, Ralph H. (1937) Village Comr., Whitefish Bay, 801 E. Lexington Blvd., Milwaukee, Wis.

Caldwell, Wallace L. (1928) Pres., Alabama Asphaltic Limestone Co., Liberty Life Bldg., Birmingham, Ala.

Calhoun, Charles G. (1933) Asst. Supt. of Bldgs., Bd. of Public Education, 5941 Ellsworth St., Philadelphia, Pa.

Campbell, John (Assoc.-1913) Cons. Engr., 8 Euclid Ave., Winchester, Mass.

Campbell, John Thomas (1931) Surveyor & Regulator, 9th District, Town Hall, Germantown, Philadelphia, Pa.

Cannon, Samuel C. (1939) Supt. Public Works, Municipal Bldg., Middletown, Conn.

Carpenter, Carl B. (1926) Asst. Engr., Charles Hurd, Cons. Engr., Calumet Theater Bldg., Hammond, Ind.

Carter, Henry L. (Assoc.-1933) Pres., Westport Paving Brick Co., Westport, Baltimore, Md.

Carter, Hugh R. (1909) Engr., 607-8 National Standard Bldg., Little Rock, Ark.

Casey, William F. (Major) (1935) City Comr., Dept. of Public Works, City Hall, Atlantic City, N. J.

Cates, H. J. (1936) Chief, Sanitary Dept., 603 City Hall, Atlanta, Ga.

Cauthorn, W. B. (1932) City Engr., P. O. Box 306, Columbia, Mo.

Cellarius, Frederick J. (1910) Cons. Civil Engr., Cellarius Eng. Bldg., Dayton, Ohio.

Chapin, Ralph S. (1937) Engr., Operation & Maintenance, Main Sewerage Pumping Station, 2nd & N St., S.E., Washington, D. C.

Christ, Edward H. (Senior-1908) Civil & Cons. Engr., Norris Bldg., Grand Rapids, Mich.

Clark, Edward S. (1921) City Mgr., City Hall, Kalamazoo, Mich.

Clark, Elmer W. (1935) Executive Asst. to Asst. Administrator, PWA, 800 21st. St., N.W., Washington, D. C.

Clayton, John B. (Jr.) (1931) City Engr., Webster Groves, Mo.

Clemmer, H. F. (1926) Engr. of Materials, District Bldg., Washington, D. C.

Cleveland, H. Burdett (Senior-1902) Cons. Sanitary Engr., 518 Fort Washington Ave., New York, N. Y.

Cloud, Harry L. (1937) Director of Public Works, Borough of Dormont, 3330 Beacon Hill Ave., Dormont, Pa.

Coburn, DeWitt M. (1937) Asst. Supt., Dept. of Public Works & Eng., 7745 Freda Ave., Dearborn, Mich.

Cohn, Morris M. (1936) Sanitary Engr., City Hall, Schenectady, N. Y.

Collins, L. W. (1925) Cons. Engr., 332 Washington Ave., Clarksburg, W. Va.

Collins, Thomas E. (1935) City Engr., City Hall, Elizabeth, N. J.

Colwell, Curtis C. (1935) Asst. County Engr., County of Essex, Hall of Records, Newark, N. J.

Conrath, W. G. (1920) Ward Supt., Bureau of Streets, 1623 Monticello Ave., Chicago, Ill.

Consoer, Arthur Wardel (1925) General Mgr., Consoer, Townsend & Quinlan, 211 W. Wacker Drive, Chicago, Ill.

Coons, Perry T. (Assoc.-1925) Mgr., Electrical Wire Rope & Construction Materials Dept., Am. Steel & Wire Co., Rockefeller Bldg., Cleveland, Ohio.

Corning, Dudley T. (Senior-1909) Chief, Bureau of Highways & Street Cleaning, 1001 City Hall Annex, Philadelphia, Pa.

Corson, Alan (1931) Chief Engr. to Comrs., Fairmont Park, Ridgeland, West Park, Philadelphia, Pa.

Corson, H. H. (1936) City Engr. & Treas., Municipal Bldg., Birmingham, Mich.

Corson, S. Cameron (Senior-1908) Supt. of Park, 1439 Powell St., Norristown, Pa.

Costello, James W. (1937) Chief Engr., Dept. Public Affairs, City Hall, Newark, N. J.

Cote, Raymond (1937) Comr. Public Works, City Hall, Woonsocket, R. I.

Cotton, Harry E. (1928) Drainage Engr., Armco Culvert Mfrs. Assn., Middletown, Ohio.

Covas, Perfecto A. (1937) Asst. Engr., Div. Eng., Dept. of Public Works, 52 City Hall, Rochester, N. Y.

Cowden, E. C. (1916) City Engr., City Hall, Harrisburg, Pa.

Cramer, Harry P. (Assoc.-1937) Sales Engr., The Shelt Co., 241 Fair Oaks Ave., Rochester, N. Y.

Craver, H. H. (Assoc.-1914) Mgr., Chemical Div., Pittsburgh Testing Lab., Stevenson & Locust Sts., Pittsburgh, Pa.

Crum, Roy W. (1935) Director, Highway Research Bd., 2101 Constitution Ave., Washington, D. C.

Crumley, H. V. (1935) President, Crumley, Jones & Crumley Co., Blue Ash & Hegner Sts., Deer Park, Cincinnati, Ohio.

Curry, John R. (1935) 4019 Carrollton Ave., Indianapolis, Ind.

Dallas, Harry A. (1937) Asst. City Engr., City Hall, Salisbury, Md.

Dalton, E. L. (Senior-1906) Cons. Engr., 803 Dallas Bank & Trust Bldg., Dallas, Tex.

Daly, Albert F. (1935) Supervisor of Public Works, Town Hall, Millburn, N. J.

Dauner, Edward J. (1929) Acting Surveyor & Regulator, 4th Survey District, 1606 W. Lehigh Ave., Philadelphia, Pa.

Davis, P. M. (1935) Engr. Inspector, PWA, P. O. Box 73, Cameron, La.

Davison, James Frederick (1935) City Engr., City Hall, Linden, N. J.

Dawes, J. C. (Honorary-1935) Ministry of Health, Whitehall S. W. 1, London, Eng.

DeBerard, W. W. (1926) Assoc. Editor, "Engineering News-Record," 520 N. Michigan Ave., Chicago, Ill.

Delany, Joseph F. (1929) Surveyor & Regulator, 5th District, 4713 N. Mascher St., Philadelphia, Pa.

DeWitt, Guy C. (1937) Asst. City Engr., 11 Bonnie Brae, Utica, N. Y.

Dey, John R. (1936) Asst. Engr., Cheltenham Township, 305 Ashbourne Rd., Elkins Park, Pa.

Dibert, Herbert M. (1923) Secy.-Treas., W. & L. E. Gurley, 514 Fulton St., Troy, N. Y.

Dodge, James Lynn (1929) 1214 Elm Ave., West Collingswood, N. J.

Dolge, Henry D. (1930) Street Sanitation Supervisor and Foreman, 2154 N. 60th St., Milwaukee, Wis.

Donelson, J. E. (Assoc.-1929) Supt., Concrete Dept., Sloss Sheffield Steel & Iron Co., 1321 N. 31st St., Birmingham, Ala.

Donnelley, L. S. (1937) Engr., Hokianga County, P. O. Box 3, Rawene, N. Z.

Donnelly, Arthur J. (1932) 5453 N. 11th St., Philadelphia, Pa.

Donohue, Jerry (1926) President, Jerry Donohue Eng. Co., 608 N. 8th St., Sheboygan, Wis.

Doremus, Goline (1920) Deputy Chief Engr., Dept. Public Affairs, City Hall, Newark, N. J.

Dorn, William Howard (1932) First Asst. Surveyor, 11 North 50th St., Philadelphia, Pa.

Douglass, Robert M. (1931) Civil & Sanitary Engr., 912 Columbia Bank Bldg., Pittsburgh, Pa.

Dow, A. W. (Senior-1899) Vice Pres. & Chief Engr., Colprovia Roads, Inc., 801 Second Ave., New York, N. Y.

Doyle, Roscoe C. (1935) Regional Project Auditor, PWA, Room 1441-20 North Wacker Drive, Chicago, Ill.

Drake, W. O. (1921) Supervising Engr., WPA, 35 E. 4th St., Corning, N. Y.

Drew, Howard Stebbins (1935) Regional Director, WPA, 13th Floor, City Hall and Co. Court House, St. Paul, Minn.

Duncan, Frank K. (1938) Chief Engr., Dept. of Public Works, 300 Municipal Office Bldg., Baltimore, Md.

Dunn, F. B. (Assoc.-1931) 309 Monroe St., Conneaut, Ohio.

Durham, Henry Welles (1913) 31 W. 11th St., New York, N. Y.

Dutton, E. R. (1914) Paving Engr., 3240 Dupont Ave., S., Minneapolis, Minn.

Earhart, Fred A. (1930) Comr. of Public Utilities, City Hall, New Orleans, La.

Earl, George G. (Senior-1906) Cons. Engr., Earl Eng. Co., Whitney Bank Bldg., New Orleans, La.

Eckert, Alfred (1936) Director of Public Works, 3 Jefferson Court, Saginaw, Mich.

Eddy, Harrison P. (Jr.) (1930) Cons. Engr., Metcalf & Eddy, 1300 Statler Bldg., Boston, Mass.

Edwards, Dean G. (1938) Cons. Engr., Borough of Manhattan Municipal Bldg., New York, N. Y.

Elgin Corporation, The (Assoc.-1932) 501 Fifth Ave., New York, N. Y.

Elgin Sweeper Company (Assoc.-1932) 5 Oak St., Elgin, Ill.

Elliott, George H. (Jr.) (1939) Assoc. Engr., Bureau of Street Cleaning, 602 Municipal Bldg., Baltimore, Md.

Ellis, Remington (1937) Junior Asst. Engr., Dept. of Eng., 486 S. Goodman St., Rochester, N. Y.

Emerson, C. A. (1917) New York Rep., Gascoigne & Associates, Woolworth Bldg., New York, N. Y.

Emigh, William C. (1937) City Engr., City Hall, Coatesville, Pa.

"Engineering News-Record" (1934) McGraw-Hill Bldg., 330 W. 42nd St., New York, N. Y.

Engle, Amos B. (1929) Surveyor & Regulator, 10th District, 6000 Rising Sun Ave., Philadelphia, Pa.

Enslow, Linn H. (1931) Vice-President & Editor, "Water Works & Sewerage," 155 E. 44th St., New York, N. Y.

Erickson, D. L. (1926) Director Parks, Public Property & Improvements, City Hall, Lincoln, Nebr.

Eschbach, Russel S. (1931) 5244 Ridge Ave., St. Louis, Mo.

Eschenfelder, Andrew (1938) Borough Engr., Municipal Bldg., Borough of Glen Ridge, N. J.

Estes, James R. (1936) City Engr., City Hall, Hattiesburg, Miss.

Evans, Miles E. (1937) Director of Public Service, 227 City Hall, Cleveland, Ohio.

Fahy, Charles A. (1931) Surveyor, 1115 Kenwyn St., Philadelphia, Pa.

Farmer, Homer G. (1937) Technical Service Director, Universal Atlas Cement Co., Chrysler Bldg., 135 E. 42nd St., New York, N. Y.

Farwell, Carroll A. (1928) Fay, Spofford & Thorndike, 11 Beacon St., Boston, Mass.

Faust, Raymond M. (1932) Bureau of Eng. Surveys and Zoning, 4611 N. Broad St., Philadelphia, Pa.

Fearing, Albert J. (1938) Director of Public Works, City Hall, New Rochelle, N. Y.

Felch, Harold E. (1937) Asst. Engr., 270 Terrace Park, Rochester, N. Y.

Fellows, Perry A. (1927) Asst. Chief Engr., WPA, 1937 38th St., Washington, D. C.

Ferebee, James L. (1921) Chief Engr. of City Sewerage Com. & County Metropolitan Sewerage Com., Box 2079, Milwaukee, Wis.

Field, Arthur M. (1938) Director, Industrial Div., Chamber of Commerce, Memphis, Tenn.

Fisch, Fred W. (1935) Director, Bureau of Traffic & City Planning, City Hall, Schenectady, N. Y.

Fisher, E. A. (1917) City Engr., City Hall, Lakewood, Ohio.

Fisher, Edwin A. (Senior-1897; Honorary-1938) Cons. Engr. (retired), 30 Albermarle St., Rochester, N. Y.

Fisher, Harry L. (1933) City Engr., City Hall, Mobile, Ala.

Fitzpatrick, F. Stuart (Assoc.-1935) Mgr., Construction & Civic Development Dept., U. S. Chamber of Commerce, 1615 H St., N. W., Washington, D. C.

Fixmer, Hugh J. (1932) Div. Eng., Bd. of Local Improvements, 207 City Hall, Chicago, Ill.

Flockhart, John S. (1930) Principal Asst. Engr., Bureau of Street Cleaning, City Hall, Newark, N. J.

Flood, Walter H. (1918) Cons. Chemical Engr., Roads, Pavements, Inspection & Testing of Matls. & Structures, 822 E. 42nd St., Chicago, Ill.

Folwell, A. Prescott (Senior-1901; Honorary-1938) Editor, "Public Works," 310 E. 45th St., New York, N. Y.

Ford, F. H. (Assoc.-1937) Pres., City Council, P. O. Box 84, Huntsville, Ala.

Foreman, Herbert E. (1931) Asst. Managing Director, Associated General Contractors of America, Munsey Bldg., Washington, D. C.

Fowler, W. S. (1926) Supt. of Sanitation, 2426 Chestnut St., Long Beach, Calif.

Frame, Richard P. (1939) Consulting Engr., 509 Warren Bldg., Michigan City, Ind.

Francisco, Ellsworth (1929) Engr. in Charge, Bureau of Lighting, City Hall, Newark, N. J.

Frickstad, Walter N. (1938) City Engr., 803 City Hall, Oakland, Calif.

Friel, Francis S. (1926) Albright & Friel, Inc., Cons. Engrs., 1520 Locust St., Philadelphia, Pa.

Frohrip, E. M. (1939) City Engr., Box 48, International Falls, Minn.

Funk, C. S. (1932) Surveyor, Bureau of Eng., Surveys & Zoning, 8031 Frankford Ave., Philadelphia, Pa.

Gabriel, John (Assoc.-1937) Mayor, 422 Blvd., Garfield, N. J.

Gaidry, Harold L. (1932) Chief Engr., Gas Dept., New Orleans Public Service, Inc., 317 Baronne St., New Orleans, La.

Gallagher, John F. (1937) Accident Analysis Engr., Dept. of Public Safety, 631 City Hall, Philadelphia, Pa.

Gallen, Leo P. (1938) Asst. Engr., Bureau of Highways & Street Cleaning, City Hall Annex, Philadelphia, Pa.

Galligan, William J. (1920) Div. Supt., Bureau of Streets, 2840 S. Calumet Ave., Chicago, Ill.

Gammie, Tom G. (1936) Secy., Okla. Planning & Resources Bd.; Director, Div. of State Planning, Okla. Planning & Resources Bd., State Capitol Bldg., Okla. City, Okla.

Gardner, Clarke (1937) City Engr., City Hall, Salisbury, Md.

Garrett, Roy Stuart (1935) Asst. City Engr., City Hall, Montgomery, Ala.

Gascoigne, George B. (1922) Cons. Engr., 1140 Leader Bldg., Cleveland, Ohio, & 1522 Woolworth Bldg., New York, N. Y.

Gates, Justin F. (1938) Comr. of Public Works, 26 Commonwealth Ave., Middletown, N. Y.

Gayton, Loran D. (1938) City Engr., City Hall, Chicago, Ill.

Gearen, M. C. (1929) Bridge Engr., Dept. of Public Works, 300 Cliff Ave., Racine, Wis.

George, Henry H. (III) (1938) Asst. Engr. in Charge of Services, City Hall, Norfolk, Va.

Gettelman, Fred, Co. (Assoc.-1928) High Speed Snow Plows, 4400 State St., Milwaukee, Wis.

Geupel, Louis A. (1937) Supt., Water Works Dept.; Cons. Engr. for City, City Hall, Evansville, Ind.

Gibbs, Joseph C. (1931) Surveyor, Bureau of Eng., Surveys & Zoning, 7236 Elmwood Ave., Philadelphia, Pa.

Giesey, Jesse K. (1922) Resident Engr., Greeley & Hansen, 31 Lowell Rd., Kenmore, N. Y.

Gill, J. Francis (1928) Comr. of Public Works, City Hall, Oswego, N. Y.

Gill, Joseph E. (1932) Asst. Engr. of Construction, Bureau of Water, Penn Athletic Club, 18th & Locust Sts., Philadelphia, Pa.

Godat, David W. (1936) Maintenance Engr., Dept. of Public Works, 18 City Hall, New Orleans, La.

Good, Raymond C. (1932) Surveyor, 2427 N. Cleveland Ave., Philadelphia, Pa.

Goodell, Paul Homer (Assoc.-1933) Illuminating Engr., Science Laboratories Inc., 3693 Vine St., Cincinnati, Ohio.

Goodrich, Robert M. (Assoc.-1937) Exec. Director, Providence Governmental Research Bureau, 32 Westminster St., Providence, R. I.

Goodridge, Harry (1929) City Engr. & Supt. of Streets, City Hall, Berkeley, Calif.

Goodspeed, Roy F. (1938) City Engr., 21203 Woodward Ave., Ferndale, Mich.

Gordon, Murray L. (1937) Town Engr., Box 95, Truro, Nova Scotia.

Graddy, J. M. (1935) Supt. of Public Works, 1401 10th Ave., Columbus, Ga.

Graham, Leland L. (1934) Director of Public Works, City Hall, Jamestown, N. Y.

Graham, Ralph C. (1935) Supt. Construction & Public Works, City Hall, Davenport, Iowa.

Grasser, Frank G. (1930) Supt. of Streets, City Hall, Kenosha, Wis.

Greeley, Samuel A. (1919) Greeley & Hansen, Cons. Engrs., Suite 1710, 6 N. Michigan Ave., Chicago, Ill.

Greenawalt Engineering Company, Inc. (Assoc.-1933) 405 Lexington Ave., New York, N. Y.

Greene, Clark M. (1937) Comr. Public Works & Eng., 13615 Michigan Ave., Dearborn, Mich.

Greenlee, B. I. (1935) Com. of Public Works, City Hall, La Grange, Ill.

Grimes, Kenneth D. (1938) Mgr. Public Affairs Div., Peoria Assn. of Commerce, Peoria, Ill.

Grisi, Adolfo P. (1937) Jefe, Estudios y Projectos, Direccion de Pavimentacion, M.O.P., Bcia, Buenos Aires, LaPlata, Argentina.

Guardia, Carlos Alberto (1937) Ingeniero Sanitario, Ministerio de Sanidad, Apartado 1175, Caracas, Venezuela.

Guillot, Albert H. (1932) Roadway Engr., New Orleans Public Service, Inc., 1423 Adams St., New Orleans, La.

Gulick, Luther (1926) Director, Institute of Public Administration, 302 E. 35th St., New York, N. Y.

Gundlach, George C. (1931) Dist. Office, Bureau of Agricultural Eng., 4870 N. Oakland Ave., Milwaukee, Wis.

Guyn, J. White (1935) Construction Engr., 375 Aylesford St., Lexington, Ky.

Hackett, Allen S. (1930) Cons. Engr., 454 Walnut St., New Orleans, La.

Haddow, A. W. (1928) City Engr., City Hall, Edmonton, Alberta, Can.

Hadley, Henry (1937) City Engr., City Hall, Verdun, Que., Can.

Hafner, Ralph (1929) Designing Traffic Draftsman, Bureau of Police, City Hall, Philadelphia, Pa.

Haldeman, Guy K. (1932) Asst. Engr., 1132 City Hall Annex, Philadelphia, Pa.

Halpin, Eugene (Jr.) (1935) Comr. of Public Works, City Hall, White Plains, N. Y.

Hamilton, Lewis C. (1932) Asst. Engr., Dept. of Public Affairs, 55 Lincoln Ave., Newark, N. J.

Hammersley, W. P. (1919) Supt. of Parks, Municipal Bldg., New Bedford, Mass.

Hancock, Edwin (1926) Cons. Municipal Engr., 1509 Jackson Blvd., Chicago, Ill.

Hannum, Erwin C. (1938) 1631 S St., N. W., Washington, D. C.

Hansell, William A. (Life-1916) Asst. Chief of Construction & Engr. of Sewers, 737 Woodland Ave., S. E., Atlanta, Ga.

Hansell, William H. (1932) Junior Surveyor, 7707 Fayette St., Philadelphia, Pa.

Hansen, Paul (1913) Greeley & Hansen, Suite 1700, 6 N. Michigan Ave., Chicago, Ill.

Harral, Henry D. (1938) Planning Engr., Lower Merion Twp., 24 Chatham Road, Ardmore, Pa.

Harris, A. Mason (1929) Chief, Bureau of Streets, 217 Governor St., Richmond, Va.

Harris, R. C. (1914) Comr. of Works, City Hall, Toronto, Ontario, Can.

Hartley, G. Russell (1936) City Engr., Municipal Bldg., Englewood, N. J.

Hartmann, Frank J. (1937) Director of Public Works, City Hall, Camden, N. J.

Hathaway, A. S. (1936) Asst. Prof., College of Eng., Northwestern Univ., 1930 Sherman Ave., Evanston, Ill.

Haulard, M. V. (1929) Supt. Municipal Repair Plant, 4154 Therville St., New Orleans, La.

Hawkins, A. J. (1922) Civil Engr., 4020 9th Court So., Birmingham, Ala.

Hawkins, C. L. (1920) Supt., Maintenance of Way, St. Louis Public Service Co., 3869 Park Ave., St. Louis, Mo.

Hawley, John B. (1912) Cons. Civil Engr., 407 Capps Bldg., Ft. Worth, Tex.

Haydock, Winters (1927) 3109 Cameron Mills Rd., Alexandria, Va.
Hayes, George P. (Jr.) (1931) Asst. Office Engr., Pennsylvania Railroad Co., Berwyn, Pa.
Haynes, Hugh P. (1925) 1220 E. 5th Ave., Winfield, Kans.
Heald, Henry Townley (1935) Pres., Armour Institute of Technology, 3300 Federal St., Chicago, Ill.
Hebden, Norman (1936) Asst. Director, Am. Public Works Assn., 1313 E. 60th St., Chicago, Ill.
Hedtler, Robert S. (1931) Cons. Engr. for Aeronautics, 1420 21st, N. W., Washington, D. C.
Heebink, G. E. (1917) Supervising Engr., Dept. of Public Works, City Offices, Beloit, Wis.
Heide, Joseph (Jr.) (Assoc.-1937) 886 Summit Ave., Jersey City, N. J.
Heil, Julius P. (Assoc.-1928) Pres., The Heil Co., Milwaukee, Wis.
Heimbuecher, Walter A. (1931) City Engr., City Hall, University City, Mo.
Helm, J. S. (Assoc.-1913) Mgr., Asphalt Sales Dept., Standard Oil Co. of N. J., 26 Broadway, New York, N. Y.
Hempelmann, W. L. (Assoc.-1911) Engr., Asphalt Sales Dept., The Texas Co., 332 S. Michigan Ave., Chicago, Ill.
Herberick, William L. (1931) Second Asst. Engr., Bureau of Eng., Surveys & Zoning, 2766 Kirkbride St., Philadelphia, Pa.
Herring, Frank W. (1935) Executive Director, Am. Public Works Assn., 1313 E. 60th St., Chicago, Ill.
Herzog, Lester W. (1924) State Administrator, WPA, Old Post Office Bldg., Albany, N. Y.
Hess, Edgar B. (1936) Civil Engr., 183 Plum St., Chillicothe, Ohio.
Hess, Wenzel J. (1931) Photographer, Bureau of Highways, 1429 N. 12th St., Philadelphia, Pa.
Hesselbacher, George E. (1934) Cheltenham Township Engr., 8200 Fairview Road, Elkins Park, Pa.
Hicklin, R. G. (1937) Mgr. Municipal Eng. Dept., Robert & Company, Inc., 706 Bona Allen Bldg., Atlanta, Ga.
Highland, Scotland G. (1921) Secy., Treas. & Gen. Mgr., Water Bd., Clarksburg, W. Va.
Hincks, Harvey W. (1937) City Engr. & Supt. of Streets, 211 City Hall, Pasadena, Calif.
Hochstadter, Irving (1928) Pres. & Technical Director, Stillman & Van Siclen, Inc., & Hochstadter Laboratories, Inc., 254 W. 31st St., New York, N. Y.
Hodson, Edward T. (1938) Comr. of Public Works, 313 Municipal Bldg., New Bedford, Mass.
Hoffmann, Robert (Senior-1908) Cons. Engr., 518 City Hall, Cleveland, Ohio.
Hoke, John B. (1929) District Engr., Interstate Amiesite Co., Stewart Bldg., Martinsburg, W. Va.
Hoots, Paul F. (1932) Chief Engr., Eng. Dept., New Orleans Public Service, Inc., 317 Baronne St., New Orleans, La.

Hopkins, Elmer W. (1931) City Engr., City Hall, Salina, Kans.
Horner, W. W. (Life-1915) Cons. Engr. & Prof. Municipal & Sanitary Eng. at Washington University, 1312 International Office Bldg., St. Louis, Mo.
Howe, Henry L. (1926) City Engr., 52 City Hall, Rochester, N. Y.
Howland, Charles A. (1923) Staff Engr., Bureau of Municipal Research, 311 S. Juniper St., Philadelphia, Pa.
Howson, L. R. (1926) Cons. Engr., Alvord, Burdick & Howson, 20 N. Wacker Drive, Chicago, Ill.
Hubbard, Prevost (1913) Chemical Engr., Asphalt Institute, 801 Second Ave., New York, N. Y.
Hubbell, Clarence W. (1928) Pres., Hubbell, Roth & Clark, Inc., Cons. Engrs., 2640 Buhl Bldg., Detroit, Mich.
Hughes, Charles A. (1938) Office Engr., City Hall, New Rochelle, N. Y.
Hughes, Charles W. (1920) Cons. Engr., 2147 Fifth St., Port Arthur, Tex.
Hughes, H. Walter (1936) Supervisor, Section Tests & Matls., 34 Court St., Rochester, N. Y.
Hunt, Edward M. (1935) Comr. of Public Works, City Engr., City Hall, Portland, Maine.
Hunter, John H. (II) (1937) Traffic Signal Engr., Traffic Eng. Div., Bureau of Police, 790 City Hall, Philadelphia, Pa.
Hyland, N. W. (1930) Asst. Director of Public Works, City Hall, Kansas City, Mo.
International Harvester Company (Assoc.-1932) 180 N. Michigan Ave., Chicago, Ill.
Ipsen, Mogens (1938) City Engr., City Hall, Rockford, Ill.
Ireland, C. B. (1938) City Engr. & St. Supt., City Hall, National City, Calif.
Ireland, C. Eugene (Assoc.-1920) Pres., Birmingham Slag Co., 2019 Sixth Ave., N., Birmingham, Ala.
Jacka, Samuel C. (1937) City Engr., City Hall, Lansing, Mich.
Jackson, M. D. (1937) City Engr., 620 Clark St., Stevens Point, Wis.
Jenkins, Frank L. (1936) City Engr., Municipal Bldg., Portland, Mich.
Jennetty, Adam (1935) Street Comr., City Hall, Perth Amboy, N. J.
Jennings, Irving C. (1929) Pres., Nash Eng. Co., South Norwalk, Conn.
Johns, Walter P. (1928) City Engr., City Hall, Wilkes-Barre, Pa.
Johnson, Andrew K. (1928) Engr. of Highways, Borough of Queens, New York City, 190-24 111th Rd., St. Albans, N. Y.
Johnston, Grant (1936) Gen. Foreman, WPA, 245 Sumac St., Wissahicken, Philadelphia, Pa.
Johnston, H. W. (1937) City Engr., City Hall, Halifax, Nova Scotia, Can.
Joseph, Ben H. (1931) Senior Surveyor, 1152 E. Brill St., Philadelphia, Pa.
Kearney, John J. (1926) Cons. Municipal Engr., 3136 Maple Ave., Berwyn, Ill.
Keating, Charles S. (1935) Cons. Engr., 400 City Hall, Syracuse, N. Y.

Keefer, Clarence E. (1922) Principal Asst. to Sewerage Engr., 1918 Mt. Royal Terrace, Baltimore, Md.

Kendall, Charles H. (1935) State Resident Highway Engr., Box 185, Woodville, Tex.

Kendall, Theodore Reed (1922) Eng. Editor, "The American City" Magazine, 470 Fourth Ave., New York, N. Y.

Kennedy, G. D. (1935) Deputy Comr., in Charge of Business Administration, State Highway Dept., Lansing, Mich.

Kenney, Francis B. (1937) City Surveyor, Dept. of Highways, City Hall, Manchester, N. H.

Kernan, Francis F. (1931) Office Engr., City Engineer's Office, University City, Mo.

Kershaw, William H. (Assoc.-1911) Asst. General Sales Mgr., Texas Co., 135 E. 42nd St., New York, N. Y.

Ketcham, Clarence H. (1934) Chief Supervising Sta. Engr., Dept. of Sanitation, 125 Worth St., New York, N. Y.

Killmer, Albert R. (1932) Transitman, 2828 N. Marston St., Philadelphia, Pa.

King, Oliver L. (1929) Abington Township Engr. & Bldg. Inspector, Township Bldg., Abington, Pa.

Kleinsteiber, John (1937) City Engr., City Bldg., Canton, Ill.

Klorer, John (1921) Cons. & Planning Engr., Sewerage & Water Bd., 526 Carondelet St., New Orleans, La.

Knapp, Kenneth J. (1936) Asst. Engr., 52 City Hall, Rochester, N. Y.

Knebes, E. L. (1926) Asst. City Engr., Rm. 407 City Hall, Milwaukee, Wis.

Koester, Edwin F. (1928) Survey & Traffic Engr., 414 W. 22nd St., Wilmington, Del.

Kohler, George F. (1929) Surveyor & Regulator, 1st Dist., 2010 Rhawn St., Philadelphia, Pa.

Kohler, H. R. (1937) Asst. Engr., 52 City Hall, Rochester, N. Y.

Kohler, Mervin H. (1937) Asst. Engr., Bureau of Eng., Surveys & Zoning, 1232 City Hall Annex, Philadelphia, Pa.

Kohnke, R. B. (1930) Asst. State Engr., Bd. of State Engrs., 207 New Orleans Court Bldg., New Orleans, La.

Kopf, Herbert P. (1937) Asst. Engr., 54 Court St., Rochester, N. Y.

Kortekamp, Harry G. (1938) Supervisor, Waste Collection Div., Dept. of Public Works, City Hall, Cincinnati, Ohio.

Kramer, Raymond M. (1931) Surveyor, 1713 Dyre St., Frankford, Philadelphia, Pa.

Kriege, H. F. (1930) Technical Director, France Stone Co., 1219 W. Bancroft St., Toledo, Ohio.

Krohn, Herman (1931) Asst. City Planning Engr., 1103 City Hall Annex, Philadelphia, Pa.

Krohne, Arthur D. (Assoc.-1937) 104 Park Ave., Takoma Park, Md.

Krupicka, Anton J. (1937) Comr., Dept. of Public Works, 5520 W. Cermak Rd., Cicero, Ill.

Kuhn, Robert J. (1932) Cons. Engr., 1644 Canal Bank Bldg., New Orleans, La.

Laboon, J. F. (1930) Director, County Dept. of Works, Allegheny County, 501 County Office Bldg., Pittsburgh, Pa.

La Guardia, F. H. (Honorary-1938) Mayor, City of New York, City Hall, New York, N. Y.

Lamson, B. F. (1925) City Engr., City Hall, St. Catharines, Ontario, Can.

Lanahan, Frank J. (Assoc.-1931) Pres., Fort Pitt Malleable Iron Co., P. O. Box 505, Pittsburgh, Pa.

Lang, T. S. (1925) City Engr., City Bldg., Clarksburg, W. Va.

Laphen, Morris (1931) District Supt., Bureau of Sts., 2840 S. Calumet Ave., Chicago, Ill.

Latimer, Claude A. (1936) Village Engr., 150 Spencer Place, Mamaroneck, N. Y.

Law, Leroy M. (1928) 460 Paul Brown Bldg., St. Louis, Mo.

Lawler, L. D. (1937) Asst. Engr., Dept. of Eng., 33 Glasgow St., Rochester, N. Y.

Lawlor, Thomas F. (1926) Cons. Engr., 140 South Cherry St., Poughkeepsie, N. Y.

Leake, George E. (1933) Ward Supt., Bureau of Streets, 208 S. Racine Ave., Chicago, Ill.

Learned, Albert P. (1926) Asst. Engr., Black & Veatch, 4706 Broadway, Kansas City, Mo.

Leary, Harry J. (1937) Asst. Director, Dept. of Public Works, 903 City Hall Annex, Philadelphia, Pa.

Lee, Frank O. (1935) Director of Public Works, City Hall, St. Petersburg, Fla.

Lee, R. B. (1918) 29 West 8th St., Hutchinson, Kans.

Leibowitz, David (1932) Asst. Engr., Pres., Borough of Bronx, Div. of Design, 2501 Davidson Ave., Bronx, New York, N. Y.

Lenhardt, Laurence G. (1936) Supt. & General Mgr., Bd. of Water Comrs., 506 Water Bd. Bldg., 735 Randolph St., Detroit, Mich.

Lewis, John V. (1934) Director of Maintenance & Operation, Dept. of Public Works, 54 Court St., Rochester, N. Y.

Liddle, F. W. (1938) City Engr., City Hall, Wyandotte, Mich.

Lingley, Ralph G. (1920) City Engr., 33 City Hall, Worcester, Mass.

Loewe, Arthur F. (1935) Special Rep., General Electric Co., 1405 Locust St., Philadelphia, Pa.

Longsdorf, Paul Wright (1929) Pres., Paul W. Longsdorf, Inc., 8125 Forrest Ave., Elkins Park, Pa.

Looney, William Henry (1935) City Engr., 517 Jefferson Ave., Stambaugh, Mich.

Loughlin, J. A. (1939) City Engr., City Hall, Wilmington, N. C.

Love, H. J. (Assoc.-1925) Mgr., National Slag Assn., 644 Earle Bldg., Washington, D. C.

Lovett, Frank Wm. (Assoc.-1933) Sanitary Engr., Link-Belt Co., 300 W. 39th St., Chicago, Ill.

Lovett, Sanford C. (1939) Supt. of Light, Bureau of Eng., 445 City-County Bldg., Pittsburgh, Pa.

Lovewell, Maurice N. (1912) Senior Asst. Engr., Chicago Park District, 7631 Luella Ave., Chicago, Ill.

Loving, M. W. (Assoc.-1923) Secy., Am. Concrete Pipe Assn., 33 West Grand Ave., Chicago, Ill.

Lyle, John M. (1933) Cons. Engr., 105 N. Berendo St., Los Angeles, Calif.

Lyons, Robert S. (1932) Asst. Supt. of Way, Philadelphia Rapid Transit Co., 7162 N. 20th St., Philadelphia, Pa.

Macallum, Andrew F. (Senior-1909) 108 Avenue Rd., Toronto, Ontario, Can.

McClelland, J. Bruce (1938) Supt. of Bldgs., The Free Library of Philadelphia, Philadelphia, Pa.

McDermott, Charles P. (1929) Chief Clerk, Bureau of City Property, 712 City Hall, Philadelphia, Pa.

McDevitt, Frank J. (1934) Director, Streets & Sewers, City Hall, St. Louis, Mo.

MacDonnell, Charles (1931) Asst. Engr., 5465 Euclid Ave., Philadelphia, Pa.

McElwain, Harold Barnard (1937) Asst. Engr., 125 Falleson Rd., Rochester, N. Y.

McFaul, William Lawrence (1924) City Engr., Bldg. Comr., & Mgr. Water Works, City Hall, Hamilton, Ontario, Can.

McGrew, E. J. (Jr.) (1938) Deputy Comr. of Public Works, Rm. 1800, Municipal Bldg., New York, N. Y.

McGruder, M. J. (1939) City Engr., City Hall, Lexington, Ky.

McJoynt, John A. (1935) General Mgr., Terminal Service Co., 716 First National Bank Bldg., Cincinnati, Ohio.

McKernan, Chas. A. (1931) Comr. Pub. Works, City Hall, Utica, N. Y.

McLaughlin, T. J. (1938) Supervising Engr., Township Rooms, Crawford, N. J.

McMullen, George (1937) Inspector, Dept. of Public Works, 34 Court St., Rochester, N. Y.

MacMurray, Paul (1938) Field Supervisor, Bur. of Highways & Street Cleaning, 926 City Hall Annex, Philadelphia, Pa.

McVea, J. C. (1919) Municipal Improvements Engr., 1318 Kipling St., Houston, Tex.

Maetzel, Paul W. (1935) City Engr., City Hall, Columbus, Ohio.

Magliano, Hilario (Dr.) (Assoc.-1937) Decano de la Facultad de Ciencias Fisicomatematics, Calle 47, esquinas 1, LaPlata, Argentina.

Mahony, J. J. (1921) City Clerk, St. Johns, Newfoundland.

Maier, Harry L. (1919) Chief Engr., Street & Sewer Dept., 229 N. Connell St., Wilmington, Del.

Mall, Ivor O. (1929) Ebasco Service, Inc., 2 Rector St., New York, N. Y.

Mallery, Earl D. (1936) Mgr., Washington Office, Am. Municipal Assn., 521-26 Transportation Bldg., Washington, D. C.

Mann, Karl M. (Assoc.-1930) Pres., "Municipal Sanitation," & "Water Works Engineering," 24 W. 40th St., New York, N. Y.
Mansfield, Myron G. (1933) Vice-Pres. & Secy., Morris Knowles, Inc., 507 Westinghouse Bldg., Pittsburgh, Pa.
Manzler, Adam T. (1936) Taylor Instrument Co., 867 Arnett Blvd., Rochester, N. Y.
Marker, James R. (Senior-1907) Chief Engr., Ohio Paving Brick Mfrs. Assn., 510 Hartman Bldg., Columbus, Ohio.
Marks, Nathaniel L. (Jr.) (1936) City Engr., 21 City Hall, New Orleans, La.
Marsh, Burton W. (1931) Director, Safety & Traffic Eng. Dept., Am. Automobile Assn., Pennsylvania Ave. at 17th St., Washington, D. C.
Marston, Frank A. (1922) Partner, Metcalf & Eddy, 1300 Statler Bldg., Boston, Mass.
Marth, Oscar (1936) Asst. Supervisor, Section Tests & Matls., Dept. of Public Works, 34 Court St., Rochester, N. Y.
Martin, E. F. (1935) City Hall, Montclair, N. J.
Martin, George E. (1933) Cons. Engr., The Barrett Co., 40 Rector St., New York, N. Y.
Martin, John L. (1932) Engr. of Way, Philadelphia Rapid Transit Co., 820 W. Dauphin St., Philadelphia, Pa.
Martin, Ralph F. (1932) Surveyor, Bureau of Eng., Surveys & Zoning, 7331 Walnut Lane, Philadelphia, Pa.
Martini, Nicholas (1938) Director Public Works, Municipal Bldg., Passaic, N. J.
Marvin, Charles W. (1937) Asst. Engr., 52 City Hall, Rochester, N. Y.
Marvin, John H. (1935) Supt. of Records, Dept. of Public Works, 345 City Hall, Cincinnati, Ohio.
Masterson, Leo J. (1931) Asst. City Planning Engr., Bureau of Eng., Surveys & Zoning, 3608 N. 19th St., Philadelphia, Pa.
Matson, Theodore M. (1931) Bureau for Street Traffic Research, 315 Strathcona Hall, Yale University, New Haven, Conn.
Matzat, Francis H. (1937) Asst. Engr., Div. of Eng. 52 City Hall, Rochester, N. Y.
Maxcy, Charles J. (1935) Director, Finance and Accounts, U. S. Housing Authority, 1629 Columbia Rd., N. W., Washington, D. C.
Maxwell, Charles W. (1938) Pres., Albany Gravel Co., Inc., Loudonville Rd., Albany, N. Y.
Meade, Harold E. (1932) General Sales Mgr., New Orleans Public Service, Inc., 317 Baronne St., New Orleans, La.
Mebus, Charles F. (1920) Cons. Engr., 112 S. Easton Road, Glenside, Pa.
Meck, William L. (1931) Principal Asst. Surveyor, Bureau of Eng., Surveys & Zoning, Edison & Dana Aves., Philadelphia, Pa.
Meckley, E. W. (1925) City Engr., City Hall, Allentown, Pa.
Metz, Herbert H. (1926) Borough Engr., 20 S. Richardson Ave., Lansdale, Pa.
Mickle, D. Grant (1935) Mgr., Traffic & Transport Dept., Jensen,

Bowen & Farrell, & Asst. Director, Mich. Highway Planning Survey, Michigan Theatre Bldg., Ann Arbor, Mich.

Miller, C. H. (Assoc.-1923) Mgr., Vitrified Dept., Laclede Christy Clay Products Co., 1711 Ambassador Bldg., St. Louis, Mo.

Miller, Edwin A. (1926) Supervisor of Maint., Dept. of Public Works, City Hall Annex, Rochester, N. Y.

Miller, J. Strother (Assoc.-1913) Technical Adviser, The Barber Asphalt Corp., Barber, N. J.

Miller, W. C. (1937) City Engr. & Treas., City Hall, St. Thomas, Ontario, Can.

Mintzer, Howard K. (1936) Supervising Estimator, Bureau of Highways, 5312 Oxford St., West Philadelphia, Pa.

Mitchell, Louis (1935) Dean of Eng. & Cons. Engr., College of Applied Science, Syracuse University, Syracuse, N. Y.

Mitchell, Robert A. (1931) Traffic Engr., Dept. of Public Safety, 790 City Hall, Philadelphia, Pa.

Mockler, John T. (1928) First Asst. Engr., 401 City Hall, Buffalo, N. Y.

Moe, Gustave A. (1928) Director of Field Staff, Public Administration Service, 11 Beacon St., Boston, Mass.

Mohr, John (1935) Dept. of Public Works, 1213 Throgmorton Ave., Bronx, New York, N. Y.

Mondello, Anthony G. (Assoc.-1932) Mgr., Dependable Eng. & Contracting Co., 156 W. Cumberland St., Philadelphia, Pa.

Moore, Thomas William (Jr.) (1938) Supervisor, Township of Union, Municipal Offices, Union, N. J.

Moorhouse, John H. (1936) Supt., Dept. of Public Service, 30 Gerald Ave., Highland Park, Mich.

Morgan, J. W. (1939) Comr. of Public Improvements, City Hall, Birmingham, Ala.

Morrison, Thomas J. (1934) 373 Grand Ave., Rochester, N. Y.

Moser, Albert W. (1931) Asst. City Planning Engr., Bureau of Eng., Surveys & Zoning, 1103 City Hall Annex, Philadelphia, Pa.

Moulthrop, H. R. (1936) Asst. Engr., Dept. of Public Works, 34 Pinnacle Rd., Rochester, N. Y.

Mudaliar, M. C. Gajaraj (1938) "A" Block, No. 7, O.U.B. Project, Jamai-Osmania, Lallaguda (Deccan), India.

Mulryan, David E. (1936) Asst. Engr., Dept. of Public Works, 426 Bay St., Rochester, N. Y.

Mulvihill, Frances J. (1928) Consultant; City Planner; Coordinator, 1028 Connecticut Ave., N. W., Washington, D. C.

"Municipal Sanitation" (Assoc.-1930) 24 West 40th St., New York, N. Y.

Murray, Edward J. (1934) Director of Public Works, City Hall, Yonkers, N. Y.

Murray, Matt S. (1926) Missouri Works Progress Administrator, 5800 Wyandotte, Kansas City, Mo.

Mussina, Lyons (1936) City Engr., City Hall, Williamsport, Pa.

Myers, Ernest S. (1932) Asst. to Pres., New Orleans Public Service, Inc., 317 Baronne St., New Orleans, La.

Naquin, Arthur J. (1932) Transportation Engr., New Orleans Public Service, Inc., 317 Baronne St., New Orleans, La.

Neeson, John H. (1925) Chief, Bureau of Eng., Surveys & Zoning, 1103 City Hall Annex, Philadelphia, Pa.

Neis, Robert E. (1936) City Director, City Hall, Monroe, Mich.

Nelson, J. Harry (Assoc.-1937) City Mgr., City Hall, Bay City, Mich.

Nemoyer, J. W. (1930) Asst. Engr., Greeley & Hansen, 6 N. Michigan Ave., Chicago, Ill.

Nichols, A. C. (Assoc.-1937) 305 S. Osceola Ave., Clearwater, Fla.

Nichols, Charles S. (1937) Director Public Service & City Engr., City Hall, Miami, Fla.

Nier, Edward F. (1936) Chief Clerk, Comr's. Office, Dept. of Public Works, 54 Court St., Rochester, N. Y.

Nilles, Philip C. (1932) Supt. of Equipment, Bureau of Streets, 2324 S. Ashland Ave., Chicago, Ill.

Noack, Arthur (1926) State Director, N. J. Geodetic Control Survey; Cons. Engr., 60 Outwater Lane, Garfield, N. J.

Norton, James G. (1934) City Engr., City Hall, Kingston, N. Y.

Nosky, Richard F. (1937) City Engr., City Hall, North Platte, Nebr.

Nowlan, Hume K. (1935) Exec. Secy., West Virginia League of Municipalities, Box 427, Charleston, W. Va.

Nunlist, H. A. (Assoc.-1935) Pres., J. A. Stewart Eng. Co., 1011 Traction Bldg., Cincinnati, Ohio.

Nygard, Carl O. (1929) Supt. of Incineration, Riverside Destructor, 28th Ave., N. and Pacific Sts., Minneapolis, Minn.

Ogden, W. H. H. (Jr.) (1929) Surveyor & Regulator, 3rd District, 1129 City Hall Annex, Philadelphia, Pa.

Ohrt, Frederick (1935) Mgr. & Chief Engr., Bd. of Water Supply, P. O. Box 3347, Honolulu, T. H.

Older, T. Fred (1936) Mgr. of Public Utilities, 125 W. Michigan Ave., Ypsilanti, Mich.

Oldham, George E. (1937) 1226 16th Ave. S., Nashville, Tenn.

Oliver, Elmer L. (1936) Asst. Engr., Dept. of Public Works, 52 City Hall, Rochester, N. Y.

Olmsted, Frederick Law (Senior-1909) Landscape Architect, Olmsted Bros., 99 Warren St., Brookline, Mass.

Olson, Herbert A. (1936) Mich. Municipal League, 205 S. State St., Ann Arbor, Mich.

O'Reilly, Andrew J. (1931) Public Safety Engr., 2207 S. Grand Blvd., St. Louis, Mo.

Orput, Raymond A. (1935) Cons. Architect & Engr., Third National Bank Bldg., Rockford, Ill.

Ostrander, V. L. (1929) Asst. Mgr., Asphalt Sales Dept., Shell Union Oil Corp., 50 W. 50th St., New York, N. Y.

Outzen, A. N. (1926) Supt. River Rouge Plant, Michigan Consolidated

Gas Co., & Supt. Natural Gas Receiving Station, P. O. Box 96, Dearborn, Mich.

Owen, Mark B. (1928) Vice-Pres., Nichols Eng. & Research Corp. of New York, 60 Wall Tower, New York City.

Paffrath, Ernest H. (1929) Asst. Sewer Comr., 2322 Clark Ave., St. Louis, Mo.

Palmer, I. Charles (1931) Div. Engr., Div. of Sewers, 420 City-County Bldg., Pittsburgh, Pa.

Parent, Arthur (Senior-1905) Consultant to City Electrical Dept., 4935 Queen Mary Road, Montreal, Quebec, Can.

Paterson, A. B. (1929) Pres., New Orleans Public Service Inc., 317 Baronne St., New Orleans, La.

Patton, Marion C. (1933) Chief Engr., Armco Culvert Mfrs. Assn., 701 Curtis St., Middletown, Ohio.

Patzig, Monroe L. (1918) Testing Engr., Patzig Testing Laboratories, 2215 Ingersoll Ave., Des Moines, Iowa.

Paul, Frederick T. (1930) City Engr., 203 City Hall, Minneapolis, Minn.

Paulson, D. O. (Assoc.-1921) Pres., Municipal Supply Co., 2508-18 S. Main St., South Bend, Ind.

Pav, Anton (1938) Comr. of Public Works, 6307 W. Cermak Rd., Berwyn, Ill.

Pearse, Langdon (1919) Sanitary Engr., Sanitary Dist. of Chicago, 910 S. Michigan Ave., Chicago, Ill.

Pease, Fred A. (1926) Pres., F. A. Pease Eng. Co., 1211 Terminal Tower, Cleveland, Ohio.

Peck, Leon F. (1913) Supt. of City Streets & Supt. Highways, Metropolitan District, Hartford County, Municipal Bldg., Hartford, Conn.

Peirce, Walter A. (1936) Mgr., Water Dept., City Hall, Racine, Wis.

Pennybacker, J. E. (Assoc.-1919) Managing Director, The Asphalt Institute, 801 Second Ave., New York, N. Y.

Perkins, William C. (Senior-1907) Chief Engr., Eastern Paving Brick Assn., Langhorne, Pa.

Perrine, J. Franklin (1921) Engr. of Sewers, Borough of Queens, Borough Hall, Long Island City, N. Y.

Perring, Henry G. (1921) Cons. Engr., Perring & Remington Co., 10 W. Chase Ct., Baltimore, Md.

Philips, James H. (1931) Chief Engr., Essex County Park Com., 115 Clifton Ave., Newark, N. J.

Phillips, Cornelius W. (1933) Supt., Dept. of Sts. & Eng., 36 Court St., Springfield, Mass.

Phillips, James (Jr.) (1934) Supt., Incineration, Dept. Public Works, P. O. Box 4, Yonkers, N. Y.

Phillips, Roy L. (1918) City Engr., City Bldg., Meadville, Pa.

Piatt, William M. (1926) Cons. Engr., Rm. 1205, 111 Corcoran St. Bldg., Durham, N. C.

Pinel, Stanley I. (1936) Research Director, Am. Public Works Assn., 1313 E. 60th St., Chicago, Ill.

Pinker, George W. (1932) Div. Supt., Bureau of Street Cleaning, 5328 N. Camac St., Philadelphia, Pa.

Pittsburgh-Des Moines Steel Company (Assoc.-1930) Neville Island Station, Pittsburgh, Pa.

Polk, Wesley W. (1936) Comr. Public Works, Comr. Streets & Supt. Water Dept., City Hall, Evanston, Ill.

Pollock, James R. (1935) City Mgr., & Director of Public Works & Utilities, City Hall, Flint, Mich.

Post, Ruden W. (1937) Supt. St. Lighting, 34 Court St., Rochester, N. Y.

Potter, Alexander (1922) Cons. Sanitary & Hydraulic Engr., 50 Church St., New York, N. Y.

Powell, John M. (1922) City Engr., City Hall, Elyria, Ohio.

Prince, Elmer W. (1935) City Mgr. & City Engr., City Hall, Morgantown, W. Va.

Quinlan, Patrick H. (1932) Drainage Engr., Sewerage & Water Board, 526 Carondelet St., New Orleans, La.

Quirk, J. Henry (1937) City Engr., City Bldg., Bradford, Pa.

Rainville, Walter S. (Jr.) (Assoc.-1932) Railway Dept., New Orleans Public Service, Inc., 317 Baronne St., New Orleans, La.

Raisch, William (1926) Cons. Engr., 227 Fulton St., New York, N. Y.

Randall, Robert H. (1939) Consultant, State & Regional Planning, National Resources Committee, North Interior Bldg., Washington, D. C.

Rangel, L. A. de Souza (1936) Chief Engr., Dept. of Public Works, Rua Buenos Ayres, No. 93-3 andar, Rio de Janeiro, Brazil.

Rankin, E. S. (Senior-1903; Honorary-1938) Div. Engr., Div. of Sewers, City Hall, Newark, N. J.

Ratcliffe, Robert C. (1937) Chief, Dept. Public Works, City Hall, Grand Junction, Colo.

Raymond, Nelson I. (1936) 610 Pine St., Owosso, Mich.

Reid, Kirk M. (Assoc.-1923) Illuminating Engr., Nela Park Eng. Dept., General Electric Co., Cleveland, Ohio.

Reidenbach, Fred W. (1936) Asst. Engr., 52 City Hall, Rochester, N. Y.

Reilly, James L. (1926) Deputy Comr. of Public Works, 18 City Hall, New Orleans, La.

Renard, Eugene Charles (1931) Res. Engr. Inspector, PWA, 480 Oakwood, Webster Groves, Mo.

Reppert, Charles M. (1921) Cons. Engr., 724 S. Negley Ave., Pittsburgh, Pa.

Requardt, G. J. (Life-1921) Cons. Engr., Whitman, Requardt & Smith, Biddle St. at Charles, Baltimore, Md.

Reynolds, Harry J. (1939) Supt. Div. of Street Cleaning and Refuse Collection, 425 Short St., Columbus, Ohio.

Richards, Arthur (1928) Engr. Exec., Municipal Bldg., Larchmont, N. Y.

Richardson, Frederick F. (1939) Mayor and Director of Public Works, City Hall, New Brunswick, N. J.

Ridley, Clarence E. (1919) Executive Director, The International City Managers Assn., 1313 E. 60th St., Chicago, Ill.

Riehl, W. H. (1928) City Engr., City Hall, Stratford, Ontario, Can.

Rigsby, R. W. (1935) Executive Officer, Farm Credit Administration, 1300 E. St. N. W., Washington, D. C.

Roberts, W. H. (1937) Comr. of Public Works, City Hall Annex, Rochester, N. Y.

Robertson, Russel A. (1933) Structural Draftsman, 1240 Sanger St., Philadelphia, Pa.

Robinson, David L., Jr. (1935) Asst. Director, Public Administration Service, 1313 E. 60th St., Chicago, Ill.

Robinson, John H. (1932) Surveyor, 451 Seville St., Philadelphia, Pa.

Roche, Alfred E. (1931) Div. Engr., WPA, 74 Chapel St., Albany, N. Y.

Roessing, Frank M. (1939) Director, Dept. of Public Works, 417 City-County Bldg., Pittsburgh, Pa.

Rogers, Allan H. (1938) Supt. of Public Works, 110 7th St., Garden City, N. Y.

Root, J. Eugene (1932) Director of Public Works, 104 City Hall, Cincinnati, Ohio.

Rosen, Milton (1931) Comr. of Public Works, 234 Court House, St. Paul, Minn.

Rosengarten, Walter E. (1929) Lower Merion Township Engr., Township Bldg., Ardmore, Pa.

Rouse, Raymond J. (1935) Supervisor of Equipment, Dept. of Public Works, City Hall, Cincinnati, Ohio.

Rowe, Ernest J. (1931) Supt., Water & Light Dept., 110 Maple Ave., Wellsville, N. Y.

Rowe, Frank (1937) Supt. of Motor Equipment of Public Works, 531 Frost Ave., Rochester, N. Y.

Ruhling, George H. (1938) Municipal Engr. on Design & Maintenance, State Highway Dept., Lansing, Mich.

Rush, Benjamin F. (1933) Chief Engr., Dept. of Public Works, City Hall, Honolulu, T. H.

Ryder, Ely M. T. (1922) Way Engr., Third Ave. Railway Co., 2396 Third Ave., New York, N. Y.

Samenfink, Herman J. (1937) Supt. of Ash & Rubbish Collection, Dept. of Public Works, 54 Court St., Rochester, N. Y.

Sammelman, C. W. S. (Life-1915) Secy. Engrs.' Club of St. Louis, 4359 Lindell Blvd., St. Louis, Mo.

Samuel, T. D. (Jr.) (1930) Chief Engr. & Supt., Water Dept., 442 W. 68th St., Kansas City, Mo.

Sanborn, George H. (1936) Deputy Comr., Public Works, 315 DeForest Road, Syracuse, N. Y.

Sandenburgh, George H. (1923) City Engr., City Hall, Ann Arbor, Mich.

Sauer, Anthony M. (1935) Supt. of City Workhouse, 3208 Colerain Ave., Cincinnati, Ohio.

Sauer, August (1932) Engr., 412 Trenton Ave., San Antonio, Tex.

Saville, Thorndike (1935) Dean & Prof. of Hydraulic & Sanitary Eng., New York University, Box 65, University Heights, New York, N. Y.

Schafmayer, A. J. (1936) Engr. Bd. of Local Improvements, 207 City Hall, Chicago, Ill.

Schaut, George G. (1932) Chief Chemist, Philadelphia Water Bureau, Belmont Ave. & Ford Rd., Philadelphia, Pa.

Scheffel, John H. (1937) Junior Asst. Engr., Dept. of Public Works, 52 City Hall, Rochester, N. Y.

Schlenz, Harry E. (Assoc.-1915) Vice-Pres. & Sales Mgr., Pacific Flush-Tank Co., 4241 Ravenswood Ave., Chicago, Ill.

Schlesinger, George F. (Senior-1907) Chief Engr. & Managing Director, National Paving Brick Assn., National Press Bldg., Washington, D. C.

Schmuhl, William B. (1932) Director, WPA, 221 Cherry St., Toledo, Ohio.

Schneider, Carl (1926) Cons. Engr., 7711 Plum St., New Orleans, La.

Schneider, Louis (1932) Surveyor, Bureau of Eng., Surveys & Zoning, 2010 Rhawn St., Philadelphia, Pa.

Schofield, Edwin R. (1932) Div. Engr., Bureau of Eng., Surveys & Zoning, 616 E. Leverington Ave., Philadelphia, Pa.

Schoonmaker, George N. (1937) Chief Engr., Lake Erie Water Supply Project, 110 Cherry St., Toledo, Ohio.

Schreiner, W. R. (1926) District Sanitary Engr., 46 Garfield, Glens Falls, N. Y.

Schroeder, A. (Honorary-1935) Weidenbornstrasse 40, Frankfurt-am-Main, Germany.

Schroeder, Albert (1936) City Engr., City Bldg., Piqua, Ohio.

Schuyler, Wm. B. (1932) Asst. Structural Engr., Bd. of Public Education, 6343 Greene St., Philadelphia, Pa.

Schwada, Joseph P. (1924) City Engr., City Hall, Milwaukee, Wis.

Scott, Robert G. (Assoc.-1937) Vice Pres. & Cons. Engr., Clay Products Assn., 111 W. Washington St., Chicago, Ill.

Semmes, Oliver J. (Jr.) (1937) City Engr., City Hall, Pensacola, Fla.

Setzer, Hubert K. (1935) Director of Public Works, P. O. Box 574, Hickory, N. C.

Shafer, Howard M. (1937) Airport Mgr., Dept. of Commerce, 34 Court St., Rochester, N. Y.

Shafer, William B. (1934) Supt. of Highways & Sewers, City-County Bldg., Pittsburgh, Pa.

Sharples, Philip P. (1923) Cons. Engr., 17 Farrar St., Cambridge, Mass.

Shaughnessy, Charles S. (1932) Chief Examiner, Civil Service Com., 975 City Hall, Philadelphia, Pa.

Shaw, George A. (1937) Borough Engr., 223 Delafield Ave., Aspinwall, Pa.

Shaw, Walter A. (1922) Cons. Engr., 30 N. LaSalle St., Chicago, Ill.

Sheddan, W. E. (1931) City Engr., City Engrs.' Bldg., Jacksonville, Fla.

Shegog, George T. (1929) Surveyor & Regulator, 11th District, 7 S. 40th St., Philadelphia, Pa.

Shepard, George M. (1934) Chief Engr., Dept. of Public Works, 234 City Hall, St. Paul, Minn.

Sheridan, Christopher J. (1934) City Engr., 74 Briggs Ave., Yonkers, N. Y.

Shifrin, Hymen (Life-1922) Cons. Engr., 1312 International Office Bldg., St. Louis, Mo.

Shimoda, Yoshito (Dr.) (1937) Director, Osaka Municipal Hygienic Lab., Osaka, Japan.

Shisler, John A. (1936) City Civil Engr., City Hall, Canton, Ohio.

Silva Freire, Victor da (1922) Pres., Humus Ltd., Sewerage & Sanitary Developments, Caixa 18, Sao Paulo, Brazil.

Simons, George W. (Jr.) (1922) Cons. Municipal Engr., Hildebrandt Bldg., Jacksonville, Fla.

Singer, Joseph (1932) First Asst. Surveyor, 1529 N. Felton St., Philadelphia, Pa.

Skelly, Joseph P. (1930) Comr. of Public Property, City Hall Annex, New Orleans, La.

Skidmore, Hugh W. (1921) Pres., Chicago Testing Lab., Inc., 536 Lake Shore Drive, Chicago, Ill.

Skinner, John F. (1921) Cons. Engr., 1610 Idlewood Rd., Glendale, Calif.

Smith, Benjamin Le Compte (1922) Cons. Engr., Whitman, Requardt & Smith, 11 N. Pearl St., Albany, N. Y.

Smith, Leon A. (1930) Supt., Water Works, City Hall, Madison, Wis.

Smith, Meloy (1937) Cons. Engr., 16 State St., Rochester, N. Y.

Smith, Nathan L. (1937) Chief Engr., Maryland State Roads Com., Federal Reserve Bank Bldg., Baltimore, Md.

Smith, Robert M. (1926) City Engr. & Director of Public Works, City Hall, Kenosha, Wis.

Snyder, Benjamin Franklin (1932) Senior Surveyor, 539 Walnut Lane, Roxborough, Philadelphia, Pa.

Solan, Cyril J. (1925) Testing Engr., 8844 198th St., Hollis, Long Island, N. Y.

Soper, George A. (1931) Cons. Engr., Middle Neck Rd., Great Neck, N. Y.

Spara, John J. (1938) Comr. of Public Works, City Hall, Lackawanna, N. Y.

Spencer, George P. (Assoc.-1931) Solvay Sales Corp., 40 Rector St., New York, N. Y.

Stanley, George C. (1937) City Engr. & Supt. Streets, City Hall, Burlington, Vt.

Stapleton, John T. (1935) 325 S. Rogers St., Bloomington, Ind.

Stapley, Edward R. (1926) Prof., Civil Eng., Okla. Agricultural & Mechanical College, 27 College Circle, Stillwater, Okla.

Starkweather, Walter (1928) Div. Civil Engr., U. S. Coast Guard, Seattle Div., 308 National Bldg., Seattle, Wash.

Sterne, George H. (1931) Surveyor, 3889 Dungan St., Philadelphia, Pa.

Stewart, John R. (1923) Town Engr., Box 447, Renfrew, Ontario, Can.

Stewart, S. W. (Assoc.-1921) Pres., Ambursen Construction Co., 295 Madison Ave., New York, N. Y.

Stilson, Alden E. (Assoc.-1929) Pres., Morse-Boulger Destructor Co., 216 East 45th St., New York, N. Y.

Stone, Donald C. (1930) Executive Director, Public Administration Service, 1313 E. 60th St., Chicago, Ill.

Stone, W. Allen (1935) County Engr., Hamilton County, Court House, Cincinnati, Ohio.

Storrer, Fredrick R. (1935) City Engr., Municipal Bldg., Dearborn, Mich.

Storrie, William (1920) Cons. Engr., Gore & Storrie, 1130 Bay St. Toronto, Ontario, Can.

Stout, Dayton Frank (1931) Surveyor, 428 Lyceum Ave., Roxborough, Philadelphia, Pa.

Strickland, Samuel H. (1938) Director of Public Works, City Hall, High Point, N. C.

Stucke, John (1937) Supt. Garbage Collection, Dept. of Public Works, 99 Versailles Rd., Rochester, N. Y.

Stupka, Peter J. (1932) Traffic Engr., Div. of Professional & Service Projects, WPA, Auditorium, 19th & E Sts., N. W., Washington, D. C.

Sullivan, Thomas F. (Col.) (1919) Chairman, Bd. of Transit Comrs., 1 Beacon St., Boston, 9, Mass.

Sweeney, Stephen B. (1938) Director, Institute Local & State Govt., University of Pennsylvania, Philadelphia, Pa.

Sydow, William (1928) Cons. Engr., 3461 Main Highway, Miami, Fla.

Talbot, A. N. (Senior-1896) Prof. of Municipal & Sanitary Eng., Emeritus, University of Ill., Urbana, Ill.

Tark, M. B. (Assoc.-1923) Engr., Link-Belt Co., 2045 W. Hunting Park Ave., Philadelphia, Pa.

Tatlock, M. W. (1938) Supt. Sewage Treatment, 911 Ferndale Ave., Dayton, Ohio.

Taylor, G. E. (1930) Deputy Street Comr., 90 Albert St., Toronto, Ontario, Can.

Taylor, Henry W. (1935) Cons. Engr., 11 Park Place, New York, N. Y.

Taylor, Ralph C. (1934) Supt., Waste Collection Div., Room 350, City Hall, Cincinnati, Ohio.

Tehan, Joseph J. (1931) Cons. Engr., 120 Flint Bldg., Auburn, N. Y.

Terrill, R. V. (1939) City Engr., City Hall, Coldwater, Mich.

Thatcher, E. Fusz (1938) City Engr., City Hall, Ferguson, Mo.

Thomas, Frank L. (1931) Professional Engr., 556 Hermit Lane, Roxborough, Philadelphia, Pa.

Thompson, George R. (1938) City Engr., City Hall, Detroit, Mich.

Thorpe, Frederick Thomas (Jr.) (1929) Surveyor & Regulator, 1129 Sanger St., Frankford, Philadelphia, Pa.

Tillson, George W. (Senior-1897) 320 S. Waiola Ave., LaGrange, Ill.

Tolles, William H. (1934) Supt. of Streets., Municipal Bldg., Nashua, N. H.

Tomlinson, Reuben C. (1932) Junior Surveyor, 6251 N. Third St., Philadelphia, Pa.

Tomlinson, W. S. (1926) City Engr., City Hall, Columbia, S. C.

Torrance, Langham (1931) Surveyor, 6th Survey District, 931 W. Lehigh Ave., Philadelphia, Pa.

Townsend, Alfred Ames (1932) Asst. Engr., Dept. of City Transit, 718 Carpenter Lane, Mt. Airy, Philadelphia, Pa.

Townsend, Darwin W. (1931) Cons. Engr., Consoer-Townsend & Quinlan, 839 N. Marshall St., Milwaukee, Wis.

Traeger, S. A. (1938) Supt., Sanitation Dept., City Hall, Minneapolis, Minn.

Transeau, Theodore E. (1932) Asst. Director, Dept. of Public Safety, 221 City Hall, Philadelphia, Pa.

Tyson, William E. (1931) Senior Surveyor, 6638 Frankford Ave., Philadelphia, Pa.

Ulsch, Nowlan M. (1937) Asst. Supt., Street Cleaning, Garbage Collection & Disposal Dept., 5th & Cleveland Sts., Jacksonville, Fla.

Upham, Charles (1926) Secy. & Engr.-Director, Am. Road Builders Assn., Natl. Press Bldg., Washington, D. C.

Vagtborg, Harold (1936) Prof. Sanitary & Municipal Eng., & Managing Director, Research Foundation, Armour Institute of Technology, 3300 Federal St., Chicago, Ill.

Van Lieu, Samuel E. (1939) Asst. Supt., Waste Collection Div., 350 City Hall, Cincinnati, Ohio.

Van Trump, Isaac (1911) Director, Van Trump Testing Lab., 2337 S. Paulina St., Chicago, Ill. & 218-223 Terminal Warehouse Bldg., Little Rock, Ark.

Varney, Henry A. (1916) Town Engr., 25 Town Hall, Brookline, Mass.

Veatch, N. T. (Jr.) (1920) Black & Veatch, Cons. Engrs., 4706 Broadway, Kansas City, Mo.

Vedder, Arthur L. (1937) Supt. of Surveys, Div. of Eng., Dept. of Public Works, 52 City Hall, Rochester, N. Y.

Veitch, Wm. M. (1932) City Engr., City Hall, London, Ontario, Can.

Velz, Clarence J. (1939) Prof. Sanitary Eng. & Head of Civil Eng. Dept., Manhattan College, New York, N. Y.

Vincenz, Jean L. (1936) Comr. Public Works & City Engr., City Hall, Fresno, Calif.

Vogt, Carl G. (1938) Supt. Maintenance & Repair, Street Dept., City Hall, East Orange, N. J.

von Phul, William (1911) Pres., Ford, Bacon & Davis, Inc., 39 Broadway, New York, N. Y.

Wagener, A. H. (1937) Director, Planning, Dept. of Commerce, 54 Court St., Rochester, N. Y.

Wagner, C. F. (1923) Chief Engr., J. B. McCrary Co., 22 Marietta St. Bldg., Atlanta, Ga.

Wagner, Gerald J. (1919) Cons. Engr., Pres., G. J. Wagner & Co., 203 Pantlind Exhibition Bldg., Grand Rapids, Mich.

Waite, Henry M. (1935) Brighton Hotel, Washington, D. C.

Walker, E. H. (1937) Structural Designer, City Engr's. Office, City Hall Annex, Rochester, N. Y.

Walker, Stanton (1926) Director of Eng., Natl. Sand & Gravel Assn., Munsey Bldg., Washington, D. C.

Wallner, George (1939) City Engr. & Supt. Water Works, City Hall, Iron Mountain, Mich.

Walls, C. A. (1938) Comr. Public Works, Village Hall, Oak Park, Ill.

Walter, Albert G. (1922) City Engr., City Hall, Dunkirk, N. Y.

Walter Motor Truck Company (Assoc.-1926) 1001-1019 Irving Ave., Ridgewood, Queens, L. I., N. Y.

Ward, James E. (1933) Asst. Highway Engr., Ill. Div. of Highways, Construction Dept., Centennial Bldg., Springfield, Ill.

Warner, C. D. (1938) Supt. Municipal Waste, 104 City Hall, Detroit, Mich.

Warren, George C. (Senior-1901) Director, Executive Committee, Warren Bros. Co., P. O. Box 1869, Boston, Mass.

Warren, Ralph L. (Senior-1905) Vice-Pres., Treas. & Director, Warren Bros. Co., P. O. Box 1869, Boston, Mass.

Watson, H. Wallace (1931) Senior Surveyor, 10th Dist., Bureau of Eng., Surveys & Zoning, 1059 Allengrove St., Frankford, Philadelphia, Pa.

Weaver, Joseph F. (1930) City Engr., 2017 County St., Portsmouth, Va.

Weaver, Stuart M. (1937) Executive Asst. to Director of Public Works, & Supt. of Water Bureau, City Hall, Montclair, N. J.

Webb, Curtis C. (Assoc.-1937) Director, Municipal Research & Service, 200 City Hall, Louisville, Ky.

Webb, J. D. (1934) City Engr., City Hall, Birmingham, Ala.

Weber, B. B. (1917) City Engr., City Hall, Oil City, Pa.

Weir, Weldon, (1938) Director of Public Works, City Hall, Asheville, N. C.

Welch, Thomas H. (1937) Supervisor Garbage Reduction, City Hall, Schenectady, N. Y.

Weller, W. Earl (1937) Director, Rochester Bureau of Municipal Research, 45 Exchange St., Rochester, N. Y.

Weston, Robert Spurr (1914) Cons. Engr., Weston & Sampson, 14 Beacon St., Boston, Mass.

White, Linn (Senior-1908) Cons. Engr., Chicago Park District, Administration Bldg., Burnham Park, Chicago, Ill.

Whitman, Ezra B. (1921) Cons. Engr., Whitman, Requardt & Smith, W. Biddle St. at Charles, Baltimore, Md.

Whitney, Charles S. (1929) Cons. Engr., 724 E. Mason St. Milwaukee, Wis.

Whitsit, Lawrence C. (1936) City Engr., 30 Gerald Ave., Highland Park, Mich.

Wichner, Arthur L. (1938) Supt. of Public Works, City Hall, West Allis, Wis.

Wightman, C. R. (1937) Director of Public Works, City Hall, Benton Harbor, Mich.

Wilder, A. D. (1938) Director, Dept. of Public Works, 260 City Hall, San Francisco, Calif.

Williams, A. C. (1936) Director Public Works, Haverford Twnp., 2325 Darby Rd., Oakmont, Dela. County, Pa.

Williams, J. A. (Assoc.-1910) Vice-Pres., Saint Mary's Sewer Pipe Co., Saint Mary's, Pa.

Williams, James A. (1937) Supt. of Public Works, Village Hall, Glencoe, Ill.

Williams, Stuart R. (1937) Mgr., Street Lighting Dept., Holophane Co., Inc., Newark, Ohio.

Willigerod, W. D. (1913) City Engr., City Hall, East Orange, N. J.

Wilson, Carl F. (1938) Supt., Dept. of Public Works, City Hall, Corning, N. Y.

Wilson, Joseph Hull (1936) Engr., Solvay Sales Corp., 2240 Lake Road Blvd., N. W., Canton, Ohio.

Wing, Frederick K. (1938) City Engr., 401 City Hall, Buffalo, N. Y.

Winship, Wilbur H. (1930) Asst. Supt., Dept. of Sanitation, 1020 Sanders St., Indianapolis, Ind.

Wise, B. A. (1916) Bradford, Pa.

Wolfe, Thomas F. (1924) Research Engr., Cast Iron Pipe Research Assn., 122 S. Michigan Ave., Chicago, Ill.

Wolfinger, Wellington R. (1918) Contractor & Engr., Curren Terrace, Norristown, Pa.

Wolman, Abel (1921) Chairman, National Water Resources Com., Prof., Sanitary Eng., Johns Hopkins University, Homewood, Baltimore, Md.

Wood, E. A. (1927) Street Cleaning & Scavenging Div., Dept. of Health, City Hall Annex, Winnipeg, Manitoba, Can.

Wood, Gar, Industries, Inc. (Assoc.-1928) 7924 Riopelle St., Detroit, Mich.

Wood, L. A. S. (Assoc.-1921) Chief Lighting Engr., Westinghouse Electric & Mfg. Co., 1216 W. 58th St., Cleveland, Ohio.

Wrenn, Lewis M. (1935) City Engr., City Hall, Pontiac, Mich.

Wyler, Albert G. (1937) Principal Asst. City Engr., City Hall, New Orleans, La.

Wynne, J. Paul (1935) Supt. of Maintenance & Operation, City Hall, Binghamton, N. Y.

Xanten, William Albert (1936) Supervisor, City Refuse Div., Eng. Dept., District Bldg., Washington, D. C.

Yard, Charles F. (1936) Principal Examiner, State Civil Service Com., Trenton, N. J.

Yocom, Stanley (1932) Chief of Architecture & Eng., Board of Public Education, 405 West School House Lane, Germantown, Philadelphia, Pa.

Young, Howard C. (1931) 10 Genesee Parkway, Cuba, N. Y.

Zollweg, Herbert A. (1937) Asst. Engr., Div. of Eng., Dept. of Public Works, 52 City Hall, Rochester, N. Y.

Geographical Distribution of Members

ALABAMA

Birmingham—Byrum, George R. (Jr.) Street Comr., 401 City Hall.
Caldwell, Wallace L., Pres., Ala. Asphaltic Limestone Co., Liberty Life Bldg.
Donelson, J. E., Supt. Concrete Dept., Sloss Sheffield Steel & Iron Co., 1321 N. 31st St.
Hawkins, A. J., Civil Engr., 4020 9th Court So.
Ireland, C. Eugene, Pres., Birmingham Slag Co., 2019 Sixth Ave., N.
Morgan, J. W., Comr. of Public Improvements, City Hall
Webb, J. D., City Engr., City Hall.
Huntsville—Ford, F. H., Pres., City Council, P. O. Box 84.
Mobile—Fisher, Harry L., City Engr., City Hall.
Montgomery—Garrett, Roy Stuart, Asst. City Engr., City Hall.

ARKANSAS

Little Rock—Carter, Hugh R., Engr., 607-8 National Standard Bldg.

CALIFORNIA

Berkeley—Goodridge, Harry, City Engr. & Supt. of Streets, City Hall.
Fresno—Vincenz, Jean L., Comr. Public Works & City Engr., City Hall.
Glendale—Skinner, John F., Cons. Engr., 1610 Idlewood Rd.
Long Beach—Fowler, W. S., Supt. of Sanitation, 2426 Chestnut St.
Los Angeles—Aldrich, Lloyd, City Engr., 600 City Hall.
Lyle, John M., Cons. Engr., 105 N. Berendo St.
National City—Ireland, C. B., City Engr. & Street Supt., City Hall.
Oakland—Frickstad, Walter N., City Engr., 803 City Hall.
Pasadena—Hincks, Harvey W., City Engr. & Supt. of Streets, 211 City Hall.
San Francisco—Wilder, A. D., Director, Dept. Public Works, 260 City Hall.

COLORADO

Grand Junction—Ratcliffe, Robert C., Chief, Dept. Public Works, City Hall.

CONNECTICUT

Bridgeport—Brewster, Peter, Director of Public Works, 18 City Hall.
Hartford—Peck, Leon F., Supt. of City Streets, & Supt. Highways, Metropolitan District, Hartford County, Municipal Bldg.
Middletown—Cannon, Samuel C., Supt. Public Works, Municipal Bldg.

New Haven—Matson, Theodore M., Bureau for Street Traffic Research, 315 Strathcona Hall, Yale University.

South Norwalk—Jennings, Irving C., Pres., Nash Eng. Co.

DELAWARE

Wilmington—Koester, Edwin F., Survey & Traffic Engr., 414 W. 22nd St.

Maier, Harry L., Chief Engr., Street & Sewer Dept., 229 N. Connell St.

DISTRICT OF COLUMBIA

Washington—Baker, Jacob, Pres., United Federal Workers of America, 532-17th St.

Bird, Byron, Senior Engr., War Dept., 1673 Columbia Rd., N. W.

Bradley, James C., Asst. Supervisor, City Refuse, District Bldg.

Brumbaugh, W. Vernon, Secy., National Lime Assn., 927-15th St., N. W.

Bullis, Lewis V., Chief Traffic Engr., WPA, 1900 F St., N. W.

Chapin, Ralph S., Engr., Operation & Maintenance, Main Sewerage Pumping Station, 2nd & N St., S. E.

Clark, Elmer W., Executive Asst. to Asst. Administrator, PWA, 800 21st St., N. W.

Clemmer, H. F., Engr. of Matls., District Bldg.

Crum, Roy W., Director, Highway Research Bd., 2101 Constitution Ave.

Fellows, Perry A., Asst. Chief Engr., WPA, 1937-38th St.

Fitzpatrick, F. Stuart, Mgr., Construction & Civic Development Dept., U. S. Chamber of Commerce, 1615 H St., N. W.

Foreman, Herbert E., Asst. Managing Director, Associated General Contractors of America, Munsey Bldg.

Hannum, Erwin C., 1631 S St., N. W.

Hedtler, Robert S., Cons. Engr. for Aeronautics, 1420-21st., N. W.

Love, H. J., Mgr., National Slag Assn., 644 Earle Bldg.

Mallery, Earl D., Mgr. Washington Office, Am. Municipal Assn., 521-26 Transportation Bldg.

Marsh, Burton W., Director, Safety & Traffic Eng. Dept., Am. Automobile Assn., Pennsylvania Ave. at 17th St.

Maxcy, Charles J., Director, Finance & Accounts, U. S. Housing Authority, 1629 Columbia Rd.

Mulvihill, Francis J., Consultant; City Planner; Coordinator, 1028 Connecticut Ave., N. W.

Randall, Robert H., Consultant, State & Regional Planning, National Resources Committee, North Interior Bldg.

Rigsby, R. W., Executive Officer, Farm Credit Administration, 1300 E St., N. W.

Schlesinger, George F., Chief Engr. & Managing Director, National Paving Brick Assn., National Press Bldg.

Stupka, Peter J., Traffic Engr., Div. of Professional & Service Projects, WPA, Auditorium, 19th & E Sts., N. W.

Upham, Charles, Secy. & Engr.-Director, Am. Road Builders Assn., National Press Bldg.

Waite, Henry M., Brighton Hotel.

Walker, Stanton, Director of Eng., Nat'l Sand & Gravel Assn., Munsey Bldg.

Xanten, William Albert, Supervisor, City Refuse Div., Eng. Dept., District Bldg.

FLORIDA

Clearwater—Nichols, A. C., 305 S. Osceola Ave.

Gainesville—Brown, Charles Carroll, Cons. Engr., Hibiscus Blvd., Rt. 2.

Jacksonville—Sheddan, W. E., City Engr., City Engrs.' Bldg.

Simons, George W. (Jr.) Cons. Municipal Engr., Hildebrandt Bldg.

Ulsch, Nowlan M., Asst. Supt., Street Cleaning, Garbage Collection & Disposal Dept., 5th & Cleveland Sts.

Miami—Nichols, Charles S., Dir. Pub. Service & City Engr., City Hall.

Sydow, William, Cons. Engr., 3461 Main Highway.

Pensacola—Semmes, Oliver J. (Jr.) City Engr., City Hall.

St. Petersburg—Lee, Frank O., Director of Public Works, City Hall.

GEORGIA

Athens—Beacham, J. G., Supt. Water Works, City Engr., City Hall.

Atlanta—Cates, H. J., Chief, Sanitary Dept., 603 City Hall.

Hansell, William A., Asst. Chief of Construction & Engr. of Sewers, 737 Woodland Ave., S. E.

Hicklin, R. G., Mgr. Municipal Eng. Dept., Robert & Company, Inc., 706 Bona Allen Bldg.

Wagner, C. F., Chief Engr., J. B. McCrary Co., 22 Marietta St. Bldg.

Columbus—Graddy, J. M., Supt. of Public Works, 1401-10th Ave.

ILLINOIS

Aurora—Austin-Western Road Machinery Co., 601 Farnsworth Ave.

Berwyn—Kearney, John J., Cons. Municipal Engr., 3136 Maple Ave.

Pav, Anton, Comr. of Public Works, 6307 W. Cermak Rd.

Canton—Kleinsteiber, John, City Engr., City Bldg.

Chicago—Anderson, A. M., Vice-Pres. & Treas., Elgin Corp., 100 N. LaSalle St.

Anderson, Arvid Anton, Mgr. Highways & Municipal Bureau, Portland Cement Assn., 33 W. Grand Ave.

Baylis, J. R., Physical Chemist, Bureau of Eng., 1643 E. 86th St.

Bigler, Hugh P., Director, Rail Steel Bar Assn., 228 N. LaSalle St.

Butler, Joseph J., Supt. Bureau of Streets, 408 City Hall.

Conrath, W. G., Ward Supt., Bureau of Streets, 1623 Monticello Ave.

Consoer, Arthur Wardel, General Mgr., Consoer, Townsend & Quinlan, 211 W. Wacker Dr.

DeBerard, W. W., Assoc. Editor, "Engineering News-Record," 520 N. Michigan Ave.
Doyle, Roscoe C., Regional Project Auditor, PWA, Room 1441-20 N. Wacker Dr.
Fixmer, Hugh J., Div. Engr., Bd. of Local Improvements, 207 City Hall.
Flood, Walter H., Cons. Chemical Engr., Roads, Pavements, Inspection & Testing of Matls. & Structures, 822 E. 42nd St.
Galligan, William J., Div. Supt., Bureau of Streets, 2840 S. Calumet Ave.
Gayton, Loran D., City Engr., City Hall.
Greeley, Samuel A., Greeley & Hansen, Cons. Engrs., Suite 1710, 6 N. Michigan Ave.
Hancock, Edwin, Cons. Municipal Engr., 1509 Jackson Blvd.
Hansen, Paul, Greeley & Hansen, Suite 1700, 6 N. Michigan Ave.
Heald, Henry Townley, Pres., Armour Institute of Technology, 3300 Federal St.
Hebden, Norman, Asst. Director, Am. Public Works Assn., 1313 E. 60th St.
Hempelmann, W. L., Engr., Asphalt Sales Dept., The Texas Co., 332 S. Michigan Ave.
Herring, Frank W., Executive Director, Am. Public Works Assn., 1313 E. 60th St.
Howson, L. R., Cons. Engr., Alvord, Burdick & Howson, 20 N. Wacker Dr.
International Harvester Company, 180 N. Michigan Ave.
Laphen, Morris, District Supt., Bureau of Streets, 2840 S. Calumet Ave.
Leake, George E. Ward Supt., Bureau of Streets, 208 S. Racine Ave.
Lovett, Frank Wm., Sanitary Engr., Link-Belt Co., 300 W. 39th St.
Lovewell, Maurice N., Senior Asst. Engr., Chicago Park District, 7631 Luella Ave.
Loving, M. W., Secy., Am. Concrete Pipe Assn., 33 W. Grand Ave.
Nemoyer, J. W., Asst. Engr., Greeley & Hansen, 6 N. Michigan Ave.
Nilles, Philip C., Supt. of Equipment, Bureau of Streets, 2324 S. Ashland Ave.
Pearse, Langdon, Sanitary Engr., Sanitary Dist. of Chicago, 910 S. Michigan Ave.
Pinel, Stanley I., Research Director, Am. Public Works Assn., 1313 E. 60th St.
Ridley, Clarence E., Executive Director, International City Managers' Assn., 1313 E. 60th St.
Robinson, David L. (Jr.) Asst. Director, Public Administration Service, 1313 E. 60th St.
Schafmayer, A. J., Engr., Board of Local Improvements, 207 City Hall.
Schlenz, Harry E., Vice-Pres. & Sales Mgr., Pacific Flush-Tank Co., 4241 Ravenswood Ave.

Scott, Robert G., Vice Pres. & Cons. Engr., Clay Products Assn., 111 W. Washington St.

Shaw, Walter A., Cons. Engr., 30 N. LaSalle St.

Skidmore, Hugh W., Pres., Chicago Testing Lab., Inc., 536 Lake Shore Dr.

Stone, Donald C., Executive Director, Public Administration Service, 1313 E. 60th St.

Vagtborg, Harold, Prof. Sanitary & Municipal Eng. & Managing Director, Research Foundation, Armour Institute of Technology, 3300 Federal St.

Van Trump, Isaac, Director, Van Trump Testing Lab., 2337 S. Paulina St.

White, Linn, Cons. Engr., Chicago Park District, Administration Bldg., Burnham Park.

Wolfe, Thomas F., Research Engr., Cast Iron Pipe Research Assn., 122 S. Michigan Ave.

Cicero—Krupicka, Anton J., Comr., Dept. of Public Works, 5520 W. Cermak Rd.

Elgin—Elgin Sweeper Company, 5 Oak St.

Evanston—Hathaway, A. S., Asst. Prof., College of Eng., Northwestern Univ., 1930 Sherman Ave.

Polk, Wesley W., Comr. Public Works, Comr. Streets & Supt. Water Dept., City Hall.

Glencoe—Williams, James A., Supt. of Public Works, Village Hall.

La Grange—Greenlee, B. I., Comr. of Public Works, City Hall.

Tillson, George W., 320 S. Waiola Ave.

Oak Park—Walls, C. A., Comr. Public Works, Village Hall.

Peoria—Grimes, Kenneth D., Mgr. Public Affairs Div., Peoria Assn. of Commerce.

Rockford—Ipsen, Mogens, City Engr., City Hall.

Orput, Raymond A., Cons. Architect & Engr., Third National Bank Bldg.

Springfield—Ward, James E., Asst. Highway Engr., Illinois Div. of Highways, Construction Dept., Centennial Bldg.

Urbana—Talbot, A. N., Prof. of Municipal & Sanitary Eng., Emeritus, University of Illinois.

Waukegan—Bleck, H. B., City Engr. & Supt. of Water Works, City Hall.

Winnetka—Anderson, Robert L., Supt. Public Works, Village Hall.

INDIANA

Bloomington—Stapleton, John T., 325 S. Rogers St.

East Chicago—Bieker, Lawrence W., Structural Engr., The Graver Corp.

Evansville—Geupel, Louis A., Supt. Water Works Dept.; Cons. Engr. for City, City Hall.

Hammond—Carpenter, Carl B., Asst. Engr., Charles Hurd, Cons. Engr., Calumet Theater Bldg.

Indianapolis—Curry, John R., 4019 Carrollton Ave.

Winship, Wilbur H., Asst. Supt., Dept. of Sanitation, 1020 Sanders St.

Michigan City—Frame, Richard P., Cons. Engr., 509 Warren Bldg.

South Bend—Paulson, D. O., Pres., Municipal Supply Co., 2508-18 S. Main St.

IOWA

Davenport—Graham, Ralph C., Supt. Construction & Public Works, City Hall.

Des Moines—Patzig, Monroe L., Testing Engr., Patzig Testing Laboratories, 2215 Ingersoll Ave.

Iowa City—Bartow, Edward, Prof., Head of Dept. of Chemistry & Chemical Eng., State University of Iowa.

KANSAS

Hutchinson—Lee, R. B., 29 W. 8th St.

Salina—Hopkins, Elmer W., City Engr., City Hall.

Topeka—Baldry, William Ernest, City Engr., 1206 W. 13th St.

Wichita—Brockway, P. L., City Engr., City Hall.

Winfield—Haynes, Hugh P., 1220 E. 5th Ave.

KENTUCKY

Lexington—Guyn, J. White, Construction Engr., 375 Aylesford St.

McGruder, J. M., City Engr., City Hall

Louisville—Webb, Curtis C., Director, Municipal Research & Service, 200 City Hall.

LOUISIANA

Cameron—Davis, P. M., Engr. Inspector, PWA, P. O. Box 73.

New Orleans—Anderson, Albert S., Asst. Supt. of Distribution, 317 Baronne St.

Billingsley, Frederic N., Cons. Engr., Billingsley Eng. Co., Interstate Bank Bldg.

Earhart, Fred A., Comr. of Public Utilities, City Hall.

Earl, George G., Cons. Engr., Earl Eng. Co., Whitney Bank Bldg.

Gaidry, Harold L., Chief Engr., Gas Dept., New Orleans Public Service Inc., 317 Baronne St.

Godat, David W., Maintenance Engr., Dept. of Public Works, 18 City Hall.

Guillot, Albert H., Roadway Engr., New Orleans Public Service Inc., 1423 Adams St.

Hackett, Allen S., Cons. Engr., 454 Walnut St.

Haulard, M. V., Supt., Municipal Repair Plant, 4154 Therville St.

Hoots, Paul F., Chief Engr., Eng. Dept., New Orleans Public Service Inc., 317 Baronne St.

Klorer, John, Cons. & Planning Engr., Sewerage & Water Bd., 526 Carondelet St.

Kohnke, R. B., Asst. State Engr., Bd. of State Engrs., 207 New Orleans Court Bldg.
Kuhn, Robert J., Cons. Engr., 1644 Canal Bank Bldg.
Marks, Nathaniel L. (Jr.) City Engr., 21 City Hall.
Meade, Harold E., General Sales Mgr., New Orleans Public Service Inc., 317 Baronne St.
Myers, Ernest S., Asst. to Pres., New Orleans Public Service Inc., 317 Baronne St.
Naquin, Arthur J., Transportation Engr., New Orleans Public Service Inc., 317 Baronne St.
Paterson, A. B., Pres., New Orleans Public Service Inc., 317 Baronne St.
Quinlan, Patrick H., Drainage Engr., Sewerage & Water Bd., 526 Carondelet St.
Rainville, Walter S. (Jr.) Railway Dept., New Orleans Public Service Inc., 317 Baronne St.
Reilly, James L., Deputy Comr. of Public Works, 18 City Hall.
Schneider, Carl, Cons. Engr., 7711 Plum St.
Skelly, Joseph P., Comr. of Public Property, City Hall Annex.
Wyler, Albert G., Principal Asst. City Engr., City Hall.
Shreveport—Barnes, H. E., City Engr., City Hall.

MAINE

Portland—Hunt, Edward M., Comr. of Public Works & City Engr., City Hall.

MARYLAND

Baltimore—Biser, D. Benton, Director & Secy., Com. on Governmental Efficiency & Economy, Inc., Mercantile Trust Bldg.
Carter, Henry L., Pres., Westport Paving Brick Co., Westport.
Duncan, Frank K., Chief Engr., Dept. of Public Works, 300 Municipal Office Bldg.
Elliott, George H. (Jr.), Assoc. Engr., Bureau of Street Cleaning, 602 Municipal Bldg.
Keefer, Clarence E., Principal Asst. to Sewerage Engr., 1918 Mt. Royal Terrace.
Perring, Henry G., Cons. Engr., Perring & Remington Co., 10 W. Chase St.
Requardt, G. J., Cons. Engr., Whitman, Requardt & Smith, W. Biddle St. at Charles.
Smith, Nathan L., Chief Engr., Maryland State Roads Com., Federal Reserve Bank Bldg.
Whitman, Ezra B., Cons. Engr., Whitman, Requardt & Smith, W. Biddle St. at Charles.
Wolman, Abel, Chairman, National Water Resources Com., & Prof., Sanitary Eng., Johns Hopkins University, Homewood.
Salisbury—Dallas, Harry A., Asst. City Engr., City Hall.
Gardner, Clarke, City Engr., City Hall.
Takoma Park—Krohne, Arthur D., 104 Park Ave.

MASSACHUSETTS

Boston—Aloff, Abraham M., Civil Service Examiner, Room 152 State House.
Barbour, Frank A., Cons. Engr., 1119 Tremont Bldg.
Eddy, Harrison P. (Jr.) Cons. Engr., Metcalf & Eddy, 1300 Statler Bldg.
Farwell, Carroll A., Fay, Spofford & Thorndike, 11 Beacon St.
Marston, Frank A., Partner, Metcalf & Eddy, 1300 Statler Bldg.
Moe, Gustave A., Director of Field Staff, Public Administration Service, 11 Beacon St.
Sullivan, Thomas F. (Col.), Chairman, Board of Transit Comrs., 1 Beacon St.
Warren, George C., Director, Executive Committee, Warren Bros. Co., P. O. Box 1869.
Warren, Ralph L., Vice-Pres., Treas. & Director, Warren Bros. Co., P. O. Box 1869.
Weston, Robert Spurr, Cons. Engr., Weston & Sampson, 14 Beacon St.
Brookline—Olmsted, Frederick Law, Landscape Architect, Olmsted Bros., 99 Warren St.
Varney, Henry A., Town Engr., 25 Town Hall.
Cambridge—Sharples, Philip P., Cons. Engr., 17 Farrar St.
New Bedford—Hammersley, W. P., Supt. of Parks, Municipal Bldg.
Hodson, Edward T., Comr. of Public Works, 313 Municipal Bldg.
Springfield—Phillips, Cornelius W., Supt., Dept. of Streets & Eng., 36 Court St.
Winchester—Campbell, John, Cons. Engr., 8 Euclid Ave.
Worcester—Lingley, Ralph G., City Engr., 33 City Hall.

MICHIGAN

Ann Arbor—Ayres, Louis Evans, Ayres, Lewis, Norris & May, 506 Wolverine Bldg.
Mickle, D. Grant, Mgr., Traffic & Transport Dept., Jensen, Bowen & Farrell & Asst. Director, Mich. Highway Planning Survey, Michigan Theater Bldg.
Olson, Herbert A., Michigan Municipal League, 205 S. State St.
Sandenburgh, George H., City Engr., City Hall.
Bay City—Nelson, J. Harry, City Mgr., City Hall.
Benton Harbor—Wightman, C. R., Director of Public Works, City Hall.
Birmingham—Corson, H. H., City Engr. & Treas., Municipal Bldg.
Coldwater—Terrill, R. V., City Engr., City Hall.
Dearborn—Coburn, De Witt M., Asst. Supt., Dept. of Public Works & Eng., 7745 Freda Ave.
Greene, Clark M., Comr. Public Works & Eng., 13615 Michigan Ave.
Outzen, A. N., Supt. River Rouge Plant, Michigan Consolidated Gas Co. & Supt., Natural Gas Receiving Station, P. O. Box 96.
Storrer, Fredrick R., City Engr., Municipal Bldg.

Detroit—Beyster, Henry E., Comr. Public Works, City Hall.
Brown, Prescott G., Senior Partner, Mason L. Brown & Sons, Civil Engrs., 120 Madison Ave.
Hubbell, Clarence W., Pres., Hubbell, Roth & Clark, Inc., Cons. Engrs., 2640 Buhl Bldg.
Lenhardt, Laurence G., Supt. & General Mgr., Bd. of Water Comrs., 506 Water Bd. Bldg., 735 Randolph St.
Thompson, George R., City Engr., City Hall
Warner, C. D., Supt. Municipal Waste, 104 City Hall.
Wood, Gar, Industries, Inc., 7924 Riopelle St.
Escanaba—Aronson, A. V., City Engr., City Hall.
Ferndale—Goodspeed, Roy F., City Engr., 21203 Woodward Ave.
Flint—Pollock, James R., City Mgr., & Director of Public Works & Utilities, City Hall.
Grand Rapids—Christ, Edward H., Civil & Cons. Engr., Norris Bldg.
Wagner, Gerald J., Cons. Engr., Pres., G. J. Wagner & Co., 203 Pantlind Exhibition Bldg.
Highland Park—Moorhouse, John H., Supt., Dept. of Public Service, 30 Gerald Ave.
Whitsit, Lawrence C., City Engr., 30 Gerald Ave.
Iron Mountain—Wallner, George, City Engr. & Supt. Water Works, City Hall.
Jackson—Biery, John M., City Engr., City Offices.
Kalamazoo—Clark, Edward S., City Mgr., City Hall.
Lansing—Jacka, Samuel C., City Engr., City Hall.
Kennedy, G. D., Deputy Comr., in Charge of Business Administration, State Highway Dept.
Ruhling, George H., Municipal Engr. on Design & Maintenance, State Highway Dept.
Monroe—Neis, Robert E., City Director, City Hall.
Owosso—Raymond, Nelson I., 610 Pine St.
Pontiac—Wrenn, Lewis M., City Engr., City Hall.
Portland—Jenkins, Frank L., City Engr., Municipal Bldg.
Saginaw—Eckert, Alfred, Director of Public Works, 3 Jefferson Court.
Stambaugh—Looney, William Henry, City Engr., 517 Jefferson Ave.
Wyandotte—Liddle, F. W., City Engr., City Hall.
Ypsilanti—Older, T. Fred, Mgr. of Public Utilities, 125 W. Michigan Ave.

MINNESOTA

International Falls—Frohrip, E. M., City Engr., Box 48.
Minneapolis—Dutton, E. R., Paving Engr., 3240 Dupont Ave., S.
Nygard, Carl O., Supt. of Incineration, Riverside Destructor, 28th Ave., N. & Pacific Sts.
Paul, Frederick T., City Engr., 203 City Hall.
Traeger, S. A., Supt., Sanitation Dept., City Hall.
St. Paul—Drew, Howard Stebbins, Regional Director, WPA, 13th Floor, City Hall & Co. Court House.

Rosen, Milton, Comr. of Public Works, 234 Court House.
Shepard, George M., Chief Engr., Dept. of Public Works, 234 City Hall.

MISSISSIPPI

Hattiesburg—Estes, James R., City Engr., City Hall.

MISSOURI

Clayton—Berry, William C., Cons. Engr., 33 N. Meramec Ave.
Columbia—Cauthorn, W. B., City Engr., P. O. Box 306.
Ferguson—Thatcher, E. Fusz, City Engr., City Hall.
Kansas City—Hyland, N. W., Asst. Director of Public Works, City Hall.
Learned, Albert P., Asst. Engr., Black & Veatch, 4706 Broadway.
Murray, Matt S., Missouri Works Progress Administrator, 5800 Wyandotte.
Samuel, T. D. (Jr.) Chief Engr. & Supt., Water Dept., 442 W. 68th St.
Veatch, N. T. (Jr.) Black & Veatch, Cons. Engrs., 4706 Broadway.
St. Louis—Barrett, Andrew E., Construction, Technical, Consulting & Designing Engr., Busman Mfg. Co., 4355 Forest Park Blvd.
Bloss, Erwin E., 1312 International Office Bldg.
Brooks, Robert B., Cons. Engr., & Member, Mo. State Highway Com., 1517 Mart Bldg.
Brown, Guy, Engr., Sewer Design, City Hall.
Eschbach, Russell S., 5244 Ridge Ave.
Hawkins, C. L., Supt., Maintenance of Way, St. Louis Public Service Co., 3869 Park Ave.
Horner, W. W., Cons. Engr. & Prof. Municipal & Sanitary Eng. at Washington University, 1312 International Office Bldg.
Law, Leroy M., 460 Paul Brown Bldg.
McDevitt, Frank J., Director, Streets & Sewers, City Hall.
Miller, C. H., Mgr. Vitrified Dept., Laclede Christy Clay Products Co., 1711 Ambassador Bldg.
O'Reilly, Andrew J., Public Safety Engr., 2207 S. Grand Blvd.
Paffrath, Ernest H., Asst. Sewer Comr., 2322 Clark Ave.
Sammelman, C. W. S., Secretary, Engrs.' Club of St. Louis, 4359 Lindell Blvd.
Shifrin, Hymen, Cons. Engr., 1312 International Office Bldg.
University City—Heimbuecher, Walter A., City Engr., City Hall.
Kernan, Francis F., Office Engr., City Engr's. Office.
Webster Groves—Clayton, John B. (Jr.) City Engr.
Renard, Eugene Charles, Res. Engr. Inspector, PWA, 480 Oakwood.

NEBRASKA

Lincoln—Erickson, D. L., Director Parks, Public Property & Improvements, City Hall.
North Platte—Nosky, Richard F., City Engr., City Hall.

NEW HAMPSHIRE

Manchester—Kenney, Francis B., City Surveyor, Dept. of Highways, City Hall.

Nashua—Tolles, William H., Supt. of Streets, Municipal Bldg.

NEW JERSEY

Ampere—Ahrens, Herman F. (Jr.) Treas., Lock Joint Pipe Co., P. O. Box 21.

Atlantic City—Casey, William F. (Major) City Comr., Dept. of Public Works, City Hall.

Barber—Miller, J. Strother, Technical Adviser, The Barber Asphalt Corp.

Bloomfield—Baechlin, Ernest, Civil Engr., 35 Lackawanna Place.

Camden—Hartmann, Frank J., Director of Public Works, City Hall.

Cranford—McLaughlin, T. J., Supervising Engr., Twp. Rooms.

East Orange—Vogt, Carl G., Supt. Maintenance & Repair, Street Dept., City Hall.

Willigerod, W. D., City Engr., City Hall.

Elizabeth—Collins, Thomas E., City Engr., City Hall.

Englewood—Hartley, G. Russell, City Engr., Municipal Bldg.

Garfield—Gabriel, John, Mayor, 422 Blvd.

Noack, Arthur, State Director, N. J. Geodetic Survey; Cons. Engr., 60 Outwater Lane.

Glen Ridge—Eschenfelder, Andrew, Borough Engr., Municipal Bldg.

Jersey City—Heide, Joseph (Jr.) 886 Summit Ave.

Kearny—Brokaw, Arthur, Town Engr., 853 Kearny Ave.

Linden—Davison, James Fredrick, City Engr., City Hall.

Millburn—Daly, Albert F., Supervisor of Public Works, Town Hall.

Montclair—Martin, E. F., City Hall.

Weaver, Stuart M., Executive Asst. to Director of Public Works, Supt. of Water Bureau, City Hall.

Newark—Andress, George W., Engr. in Charge, Bureau of Streets, City Hall.

Blackwell, W. T., General Lighting Rep., Public Service Electric & Gas Co., 80 Park Place.

Colwell, Curtis C., Asst. County Engr., County of Essex, Hall of Records.

Costello, James W., Chief Engr., Dept. Public Affairs, City Hall.

Doremus, Goline, Deputy Chief Engr., Dept. Public Affairs, City Hall.

Flockhart, John S., Principal Asst. Engr., Bureau of Street Cleaning, City Hall.

Francisco, Ellsworth, Engr. in Charge, Bureau of Lighting, City Hall.

Hamilton, Lewis C., Asst. Engr., Dept. of Public Affairs, 55 Lincoln Ave.

Philips, James H., Chief Engr., Essex County Park Com., 115 Clifton Ave.

Rankin, E. S., Div. Engr., Div. of Sewers, City Hall.

New Brunswick—Richardson, Frederick F., Mayor and Director of Public Works, City Hall.
Passaic—Martini, Nicholas, Director of Public Works, Municipal Bldg.
Perth Amboy—Booz, Louis P., Cons. Engr., 263 Madison Ave.
Jennetty, Adam, Street Comr., City Hall.
Trenton—Yard, Charles F., Principal Examiner, State Civil Service Com.
Union—Moore, Thomas William (Jr.) Supervisor, Twp. of Union, Municipal Offices.
West Collingswood—Dodge, James Lynn, 1214 Elm Ave.

NEW YORK

Albany—Herzog, Lester W., State Administrator WPA, Old Post Office Bldg.
Maxwell, Charles W., Pres., Albany Gravel Co., Inc., Loudonville Rd.
Roche, Alfred E., Div. Engr., WPA, 74 Chapel St.
Smith, Benjamin Le Compte, Cons. Engr., Whitman, Requardt & Smith, 11 N. Pearl St.
Auburn—Tehan, Joseph J., Cons. Engr., 120 Flint Bldg.
Binghamton—Wynne, J. Paul, Supt. of Maintenance & Operation, City Hall.
Buffalo—Mockler, John T., First Asst. Engr., 401 City Hall.
Wing, Frederick K., City Engr., 401 City Hall.
Corning—Drake, W. O., Supervising Engr., WPA, 35 E. 4th St.
Wilson, Carl F., Supt., Dept. Public Works, City Hall.
Cuba—Young, Howard C., 10 Genesee Parkway.
Dunkirk—Walter, Albert G., City Engr., City Hall.
Forest Hills—Butterfield, Elmore E., Chemist & Inventor, 70-04 Dartmouth St.
Garden City—Rogers, Allan H., Supt. of Public Works, 110 7th St.
Glens Falls—Schreiner, W. R., District Sanitary Engr., 46 Garfield.
Great Neck—Soper, George A., Cons. Engr., Middle Neck Rd.
Hollis—Solan, Cyril J., Testing Engr., 8844 198th St.
Jamestown—Graham, Leland L., Director of Public Works, City Hall.
Kenmore—Giesey, Jesse K., Resident Engr., Greeley & Hansen, 31 Lowell Rd.
Kingston—Norton, James G., City Engr., City Hall.
Lackawanna—Spara, John J., Comr. of Public Works, City Hall.
Larchmont—Richards, Arthur, Engr. Executive, Municipal Bldg.
Long Island City—Perrine, J. Franklin, Engr. of Sewers, Borough of Queens, Borough Hall.
Mamaroneck—Latimer, Claude A., Village Engr., 150 Spencer Place.
Middletown—Gates, Justin F., Comr. of Public Works, 26 Commonwealth Ave.
New Rochelle—Fearing, Albert J., Director of Public Works, City Hall.
Hughes, Charles A., Office Engr., City Hall.
New York—Bachmann, Frank, Mgr., Sanitary Eng. Div., The Dorr Co., 570 Lexington Ave.

Cleveland, H. Burdett, Cons. Sanitary Engr., 518 Fort Washington Ave.
Dow, A. W., Vice-Pres. & Chief Engr., Colprovia Roads, Inc., 801 Second Ave.
Durham, Henry Welles, 31 W. 11th St.
Edwards, Dean G., Cons. Engr., Borough of Manhattan, Municipal Bldg.
Elgin Corporation, The, 501 Fifth Ave.
Emerson, C. A., New York Rep., Gascoigne & Associates, Woolworth Bldg.
"Engineering News-Record," McGraw-Hill Bldg., 330 W. 42nd St.
Enslow, Linn H., Vice-Pres. & Editor, "Water Works & Sewerage," 155 E. 44th St.
Farmer, Homer G., Technical Service Director, Universal Atlas Cement Co., Chrysler Bldg., 135 E. 42nd St.
Folwell, A. Prescott, Editor, "Public Works," 310 E. 45th St.
Greenawalt Engineering Company, Inc., 405 Lexington Ave.
Gulick, Luther, Director, Institute of Public Administration, 302 E. 35th St.
Helm, J. S., Mgr., Asphalt Sales Dept., Standard Oil Co. of N. J., 26 Broadway.
Hochstadter, Irving, Pres. & Technical Director, Stillman & Van Siclen, Inc. & Hochstadter Laboratories, Inc., 254 W. 31st St.
Hubbard, Prevost, Chemical Engr., Asphalt Institute, 801 Second Ave.
Kendall, Theodore Reed, Eng. Editor, "The American City Magazine," 470 Fourth Ave.
Kershaw, William H., Asst. General Sales Mgr., Texas Co., 135 E. 42nd St.
Ketcham, Clarence H., Chief Supervising Sta. Engr., Dept. of Sanitation, 125 Worth St.
La Guardia, F. H., Mayor, City Hall.
Leibowitz, David, Asst. Engr. & Pres., Borough of Bronx, Div. of Design, 2501 Davidson Ave., Bronx.
McGrew, E. J. (Jr.) Deputy Comr. of Public Works, Room 1800, Municipal Bldg.
Mall, Ivor O., Ebasco Service, 2 Rector St.
Mann, Karl M., Pres., "Municipal Sanitation" & "Water Works Engineering," 24 W. 40th St.
Martin, George E., Cons. Engr., The Barrett Co., 40 Rector St.
Mohr, John, Dept. of Public Works, 1213 Throgmorton Ave., Bronx.
"Municipal Sanitation," 24 West 40th St.
Ostrander, V. L., Asst. Mgr., Asphalt Sales Dept., Shell Union Oil Corp., 50 W. 50th St.
Owen, Mark B., Vice-Pres., Nichols Eng. & Research Corp. of New York, 60 Wall Tower.
Pennybacker, J. E., Managing Director, The Asphalt Institute, 801 Second Ave.
Potter, Alexander, Cons. Sanitary & Hydraulic Engr., 50 Church St.

Raisch, William, Cons. Engr., 227 Fulton St.
Ryder, Ely M. T., Way Engr., Third Ave. Railway Co., 2396 Third Ave.
Saville, Thorndike, Dean & Prof. of Hydraulic & Sanitary Eng., New York University, Box 65, University Heights.
Spencer, George P., Solvay Sales Corp., 40 Rector St.
Stewart, S. W., Pres., Ambursen Construction Co., 295 Madison Ave.
Stilson, Alden, Pres., Morse-Boulger Destructor Co., 216 E. 45th St.,
Taylor, Henry W., Cons. Engr., 11 Park Pl.
Velz, Clarence J., Prof. Sanitary Eng. & Head of Civil Eng. Dept., Manhattan College.
von Phul, William, Pres., Ford, Bacon & Davis, Inc., 39 Broadway.

Oswego—Gill, J. Francis, Comr. of Public Works, City Hall.

Poughkeepsie—Lawlor, Thomas F., Cons. Engr., 140 South Cherry St.

Ridgewood—Walter Motor Truck Company, 1001-1019 Irving Ave., Queens.

Rochester—Bryan, Hiram E., Asst. Engr., City Map Survey, Div. of Eng., 242 City Hall Annex.
Covas, Perfecto A., Asst. Engr., Div. Eng., Dept. of Public Works, 52 City Hall.
Cramer, Harry P., Sales Engr., The Shelt Co., 241 Fair Oaks Ave.
Ellis, Remington, Jr. Asst. Engr., Dept. of Eng., 486 S. Goodman St.
Felch, Harold E., Asst. Engr., 270 Terrace Park.
Fisher, Edwin A., Cons. Engr. (retired), 30 Albermarle St.
Howe, Henry L., City Engr., 52 City Hall.
Hughes, H. Walter, Supervisor, Section Tests & Matls., 34 Court St.
Knapp, Kenneth J., Asst. Engr., 52 City Hall.
Kohler, H. R., Asst. Engr., 52 City Hall.
Kopf, Herbert P., Asst. Engr., 54 Court St.
Lawler, L. D., Asst. Engr., Dept. of Eng., 33 Glasgow St.
Lewis, John V., Director of Maintenance & Operation, Dept. of Public Works, 54 Court St.
McElwain, Harold Barnard, Asst. Engr., 125 Falleson Rd.
McMullen, George, Inspector, Dept. of Public Works, 34 Court St.
Manzler, Adam T., Taylor Instrument Co., 867 Arnett Blvd.
Marth, Oscar, Asst. Supervisor, Section Tests & Matls., Dept. of Public Works, 34 Court St.
Marvin, Charles W., Asst. Engr., 52 City Hall.
Matzat, Francis H., Asst. Engr., Div. of Eng., 52 City Hall.
Miller, Edwin A., Supervisor of Maintenance, Dept. of Public Works, City Hall Annex.
Morrison, Thomas J., 373 Grand Ave.
Moulthrop, H. R., Asst. Engr., Dept. of Public Works, 34 Pinnacle Rd.
Mulryan, David E., Asst. Engr., Dept. of Public Works, 426 Bay St.
Nier, Edward F., Chief Clerk, Comr's. Office, Dept. of Public Works, 54 Court St.
Oliver, Elmer L., Asst. Engr., Dept. of Public Works, 52 City Hall.
Post, Ruden W., Supt. St. Lighting, 34 Court St.

Reidenbach, Fred W., Asst. Engr., 52 City Hall.
Roberts, W. H., Comr. of Public Works, City Hall Annex.
Rowe, Frank, Supt. of Motor Equipment of Public Works, 531 Frost Ave.
Samenfink, Herman J., Supt. of Ash & Rubbish Collection, Dept. of Public Works, 54 Court St.
Scheffel, John H., Jr. Asst. Engr., Dept. of Public Works, 52 City Hall.
Shafer, Howard M., Airport Mgr., Dept. of Commerce, 34 Court St.
Smith, Meloy, Cons. Engr., 16 State St.
Stucke, John, Supt. Garbage Collection, Dept. of Public Works, 99 Versailles Rd.
Vedder, Arthur L., Supt. of Surveys, Div. of Eng., Dept. of Public Works, 52 City Hall.
Wagener, A. H., Director of Planning, Dept. of Commerce, 54 Court St.
Walker, E. H., Structural Designer, City Engr's. Office, City Hall Annex.
Weller, W. Earl, Director, Rochester Bureau of Municipal Research, 45 Exchange St.
Zollweg, Herbert A., Asst. Engr., Div. of Eng., Dept. of Public Works, 52 City Hall.

St. Albans—Johnson, Andrew K., Engr. of Highways, Borough of Queens, New York City, 190-24 111th Rd.

Scarsdale—Boniface, Arthur, Village Engr. & Mgr., P. O. Box 67.

Schenectady—Cohn, Morris M., Sanitary Engr., City Hall.
Fisch, Fred W., Director, Bureau of Traffic & City Planning, 205 City Hall.
Welch, Thomas H., Supervisor Garbage Reduction, City Hall.

Syracuse—Ballantyne, George H., Comr. of Public Works, 208 City Hall.
Keating, Charles S., Cons. Engr., 400 City Hall.
Mitchell, Louis, Dean of Eng. & Cons. Engr., College of Applied Science, Syracuse University.
Sanborn, George H., Deputy Comr., Public Works, 315 DeForest Rd.

Troy—Dibert, Herbert M., Secy. & Treas., W. & L. E. Gurley, 514 Fulton St.

Utica—DeWitt, Guy C., Asst. City Engr., 11 Bonnie Brae.
McKernan, Chas. A., Comr. Public Works, City Hall.

Wellsville—Rowe, Ernest J., Supt., Water & Light Dept., 110 Maple Ave.

White Plains—Halpin, Eugene (Jr.) Comr. of Public Works, City Hall.

Yonkers—Murray, Edward J., Director of Public Works, City Hall.
Phillips, James (Jr.) Supt., Incineration, Dept. Public Works, P. O. Box 4.
Sheridan, Christopher J., City Engr., 74 Briggs Ave.

NORTH CAROLINA

Asheville—Weir, Weldon, Director of Public Works, City Hall.

Durham—Piatt, William M., Cons. Engr., Rm. 1205, 111 Corcoran St. Bldg.

Hickory—Setzer, Hubert K., Director of Public Works, P. O. Box 574.
High Point—Strickland, Samuel H., Director of Public Works, City Hall.
Wilmington—Loughlin, J. A., City Engineer, City Hall.

OHIO

Canton—Barr, Warren L., Secy.-Treas., Metropolitan Paving Brick Assn.
Shisler, John A., City Civil Engr., City Hall.
Wilson, Joseph Hull, Engr., Solvay Sales Corp., 2240 Lake Road Blvd., N. W.
Chillicothe—Hess, Edgar B., Civil Engr., 183 Plum St.
Cincinnati—Brokaw, Charles E., Supt., Highway Maintenance Div., City Hall.
Crumley, H. V., Pres., Crumley, Jones & Crumley Co., Blue Ash & Hegner Sts., Deer Park.
Goodell, Paul Homer, Illuminating Engr., Science Laboratories Inc., 3693 Vine St.
Kortekamp, Harry G., Supervisor, Waste Collection Div., Dept. of Public Works, City Hall.
McJoynt, John A., General Mgr., Terminal Service Co., 716 First National Bank Bldg.
Marvin, John H., Supt., Records, Dept. of Public Works, 345 City Hall.
Nunlist, H. A., Pres., J. A. Stewart Eng. Co., 1011 Traction Bldg.
Root, J. Eugene, Director of Public Works, 104 City Hall.
Rouse, Raymond J., Supervisor of Equipment, Dept. of Public Works, City Hall.
Sauer, Anthony M., Supt. of City Workhouse, 3208 Colerain Ave.
Stone, W. Allen, County Engr., Hamilton County, Court House.
Taylor, Ralph C., Supt., Waste Collection Div., 350 City Hall.
Van Lieu, Samuel E., Asst. Supt., Waste Collection Div., 350 City Hall.
Cleveland—Coons, Perry T., Mgr., Electrical Wire Rope & Construction Matls. Dept., Am. Steel & Wire Co., Rockefeller Bldg.
Evans, Miles E., Director of Public Service, 227 City Hall.
Gascoigne, George B., Cons. Engr., 1140 Leader Bldg.
Hoffman, Robert, Cons. Engr., 518 City Hall.
Pease, Fred A., Pres., F. A. Pease Eng. Co., 1211 Terminal Tower.
Reid, Kirk M., Illuminating Engr., Nela Park Eng. Dept., General Electric Co.
Wood, L. A. S., Chief Lighting Engr., Westinghouse Electric & Mfg. Co., 1216 W. 58th St.
Columbus—Maetzel, Paul W., City Engr., City Hall.
Marker, James R., Chief Engr., Ohio Paving Brick Mfrs. Assn., 510 Hartman Bldg.
Reynolds, Harry J., Supt., Div. of Street Cleaning and Refuse Collection, 425 Short St.
Conneaut—Dunn, F. B., 309 Monroe St.

Dayton—Cellarius, Frederick J., Cons. Civil Engr., Cellarius Eng. Bldg.
Tatlock, M. W., Supt. Sewage Treatment, 911 Ferndale Ave.
Elyria—Powell, John M., City Engr., City Hall.
Lakewood—Fisher, E. A., City Engr., City Hall.
Lorain—Alexander, Henry F., City Engr., 366 Oberlin Ave.
Marion—Browne, Floyd G., Sanitary Engr., Box 134.
Middletown—Cotton, Harry E., Drainage Engr., Armco Culvert Mfrs. Assn.
Patton, Marion C., Chief Engr., Armco Culvert Mfrs. Assn., 701 Curtis St.
Newark—Williams, Stuart R., Mgr., Street Lighting Dept., Holophane Co., Inc.
Piqua—Schroeder, Albert, City Engr., City Bldg.
Toledo—Kriege, H. F., Technical Director, France Stone Co., 1219 W. Bancroft St.
Schmuhl, William B., Director, WPA, 221 Cherry St.
Schoonmaker, George N., Chief Engr., Lake Erie Water Supply Project, 110 Cherry St.

OKLAHOMA

Oklahoma City—Gammie, Tom G., Secy., Okla. Planning & Resources Bd., & Director, Div. of State Planning, Okla. Planning & Resources Bd., State Capitol Bldg.
Stillwater—Stapley, Edward R., Prof., Civil Eng., Okla. Agricultural & Mechanical College, 27 College Circle.

OREGON

Portland—Bean, Ormond R., City Comr., 414 City Hall.

PENNSYLVANIA

Abington—King, Oliver L., Abington Township Engr. & Bldg. Inspector, Township Bldg.
Allentown—Brown, James F., 1624 Chew St.
Meckley, E. W., City Engr., City Hall.
Ardmore—Harral, Henry D., Planning Engr. for Lower Merion Twp., 24 Chatham Rd.
Rosengarten, Walter E., Lower Merion Twp. Engr., Twp. Bldg.
Aspinwall—Shaw, George A., Borough Engr., 223 Delafield Ave.
Berwyn—Hayes, George P. (Jr.) Office Engr., Pennsylvania Railroad Co.
Bradford—Quirk, J. Henry, City Engr., City Bldg.
Wise, B. A.
Coatesville—Emigh, William C., City Engr., City Hall.
Dormont—Cloud, Harry L., Director of Public Works, Borough of Dormont, 3330 Beacon Hill Ave.
Elkins Park—Dey, John R., Asst. Engr., Cheltenham Township, 305 Ashbourne Rd.
Hesselbacher, George E., Cheltenham Township Engr., 8200 Fairview Rd.

Longsdorf, Paul Wright, Pres., Paul W. Longsdorf, Inc., 8125 Forrest Ave.

Glenside—Mebus, Charles F., Cons. Engr., 112 S. Easton Rd.

Harrisburg—Cowden, E. C., City Engr., City Hall.

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Lansdale—Metz, Herbert H., Borough Engr., 20 S. Richardson Ave.

Meadville—Bogardus, Theodore S., Asst. City Engr., City Bldg.

Phillips, Roy L., City Engr., City Bldg.

Norristown—Corson, S. Cameron, Supt. of Park, 1439 Powell St.

Wolfinger, Wellington R., Contractor & Engr., Curren Terrace.

Oakmont—Williams, A. C., Director, Public Works, Haverford Township.

Oil City—Weber, B. B., City Engr., City Hall.

Philadelphia—Abbot, Munro L., Surveyor & Regulator, 6th District, Bureau of Eng., Surveys & Zoning, 931 W. Lehigh Ave.

Adler, Julius, Cons. Engr., 2001 Architects Bldg., 17th & Sansom Sts.

Bareuther, Charles A., Engr. Examiner, Civil Service Com., 975 City Hall.

Baxter, Samuel S., Asst. Engr., Bureau of Eng., Surveys & Zoning, 5221 Horrocks St.

Berry, Benjamin L., 2130 N. 18th St.

Boatrite, James E., Structural Engr., 4632 Greene St., Germantown.

Briggs, John (Jr.) 4736 Large St.

Brooks, Ernest R., Surveyor, Bureau of Eng., Surveys & Zoning, 931 W. Lehigh Ave.

Buckley, Thomas, Asst. Chief Engr. & Surveyor, Bureau of Eng., Surveys & Zoning, 1102 City Hall Annex.

Calhoun, Charles G., Asst. Supt. of Bldgs., Bd. of Public Education, 5941 Ellsworth St.

Campbell, John Thomas, Surveyor & Regulator, 9th District, Town Hall, Germantown.

Corning, Dudley T., Chief, Bureau of Highways & Street Cleaning, 1001 City Hall Annex.

Corson, Alan, Chief Engr. to Comrs. of Fairmont Park, Ridgeland, West Park.

Dauner, Edward J., Acting Surveyor & Regulator, 4th Survey District, 1006 W. Lehigh Ave.

Delany, Joseph F., Surveyor & Regulator, 5th District, 4713 N. Mascher St.

Donnelly, Arthur J., 5453 N. 11th St.

Dorn, William Howard, First Asst. Surveyor, 11 N. 50th St.

Engle, Amos B., Surveyor & Regulator, 10th District, 6000 Rising Sun Ave.

Fahy, Charles A., Surveyor, 1115 Kenwyn St.

Faust, Raymond M., Jr. Surveyor, Bureau of Eng., Surveys & Zoning, 4611 N. Broad St.

Friel, Francis S., Albright & Friel, Inc., Cons. Engrs., 1520 Locust St.

Funk, C. S., Surveyor, Bureau of Eng., Surveys & Zoning, 8031 Frankford Ave.
Gallagher, John F., Accident Analysis Engr., Dept. of Public Safety, 631 City Hall.
Gallen, Leo P., Asst. Engr., Bureau of Highways & Street Cleaning, City Hall Annex.
Gibbs, Joseph C., Surveyor, Bureau of Eng., Surveys & Zoning, 7236 Elmwood Ave.
Gill, Joseph E., Asst. Engr. of Construction, Bureau of Water, Penn Athletic Club, 18th & Locust Sts.
Good, Raymond C., Surveyor, 2427 N. Cleveland Ave.
Hafner, Ralph, Designing Traffic Draftsman, Bureau of Police, City Hall.
Haldeman, Guy K., Asst. Engr., 1132 City Hall Annex.
Hansell, William H., Jr. Surveyor, 7707 Fayette St.
Herberick, William L., Second Asst. Engr., Bureau of Eng., Surveys & Zoning, 2766 Kirkbride St.
Hess, Wenzel J., Photographer, Bureau of Highways, 1429 N. 12th St.
Howland, Charles A., Staff Engr., Bureau of Municipal Research, 311 S. Juniper St.
Hunter, John H., II, Traffic Signal Engr., Traffic Eng. Div., Bureau of Police, 790 City Hall.
Johnston, Grant, Gen. Foreman, WPA, 245 Sumac St., Wissahicken.
Joseph, Ben H., Senior Surveyor, 1152 E. Brill St.
Killmer, Albert R., Transitman, 2828 N. Marston St.
Kohler, George F., Surveyor & Regulator, 1st District, 2010 Rhawn St.
Kohler, Mervin H., Asst. Engr., Bureau of Eng., Surveys & Zoning, 1232 City Hall Annex.
Kramer, Raymond M., Surveyor, 1713 Dyre St., Frankford.
Krohn, Herman, Asst. City Planning Engr., 1103 City Hall Annex.
Leary, Harry J., Asst. Director, Dept. of Public Works, 903 City Hall Annex.
Loewe, Arthur F., Special Rep., General Electric Co., 1405 Locust St.
Lyons, Robert S., Asst. Supt. of Way, Philadelphia Rapid Transit Co., 7162 N. 20th St.
McClelland, J. Bruce, Supt. of Bldgs., The Free Library of Philadelphia.
McDermott, Charles P., Chief Clerk, Bureau of City Property, 712 City Hall.
MacDonnell, Charles, Asst. Engr., 5465 Euclid Ave.
MacMurray, Paul, Field Supervisor, Bur. of Highways & Street Cleaning, 926 City Hall Annex.
Martin, John L., Engr. of Way, Philadelphia Rapid Transit Co., 820 W. Dauphin St.
Martin, Ralph F., Surveyor, Bureau of Eng., Surveys & Zoning, 7331 Walnut Lane.
Masterson, Leo J., Asst. City Planning Engr., Bureau of Eng., Surveys & Zoning, 3608 N. 19th St.

Meck, William L., Principal Asst. Surveyor, Bureau of Eng., Surveys & Zoning, Edison & Dana Aves.
Mintzer, Howard K., Supervising Estimator, Bureau of Highways, 5312 Oxford St.
Mitchell, Robert A., Traffic Engr., Dept. Public Safety, 790 City Hall Annex.
Mondello, Anthony G., Mgr., Dependable Eng. & Contracting Co., 156 W. Cumberland St.
Moser, Albert W., Asst. City Planning Engr., Bureau of Eng., Surveys & Zoning, 1103 City Hall Annex.
Neeson, John H., Chief, Bureau of Eng., Surveys & Zoning, 1103 City Hall Annex.
Ogden, W. H. H. (Jr.) Surveyor & Regulator, 3rd District, 1129 City Hall Annex.
Pinker, George W., Div. Supt., Bureau of Street Cleaning, 5328 N. Camac St.
Robertson, Russel A., Structural Draftsman, 1240 Sanger St.
Robinson, John H., Surveyor, 451 Seville St.
Schaut, George G., Chief Chemist, Philadelphia Water Bureau, Belmont Ave. & Ford Rd.
Schneider, Louis, Surveyor, Bureau of Eng., Surveys & Zoning, 2010 Rhawn St.
Schofield, Edwin R., Div. Engr., Bureau of Eng., Surveys & Zoning, 616 E. Leverington Ave.
Schuyler, Wm. B., Asst. Structural Engr., Bd. of Public Education, 6343 Greene St.
Shaughnessy, Charles S., Chief Examiner, Civil Service Com., 975 City Hall.
Shegog, George T., Surveyor & Regulator, 11th District, 7 S. 40th St.
Singer, Joseph, First Asst. Surveyor, 1529 N. Felton St.
Snyder, Benjamin Franklin, Senior Surveyor, 539 Walnut Lane, Roxborough.
Sterne, George H., Surveyor, 3889 Dungan St.
Stout, Dayton Frank, Surveyor, 428 Lyceum Ave., Roxborough.
Sweeney, Stephen B., Director, Institute Local & State Govt., University of Pennsylvania.
Tark, M. B., Engr., Link-Belt Co., 2045 W. Hunting Park Ave.
Thomas, Frank L., Professional Engr., 556 Hermit Lane, Roxborough.
Thorpe, Frederick Thomas (Jr.) Surveyor & Regulator, 1129 Sanger St., Frankford.
Tomlinson, Reuben C., Jr. Surveyor, 6251 N. Third St.
Torrance, Langham, Surveyor, 6th Survey District, 931 W. Lehigh Ave.
Townsend, Alfred Ames, Asst. Engr., Dept. of City Transit, 718 Carpenter Lane, Mt. Airy.
Transeau, Theodore E., Asst. Director, Dept. of Public Safety, 221 City Hall.

Watson, H. Wallace, Senior Surveyor, 10th Dist., Bureau of Eng., Surveys & Zoning, 1059 Allengrove St., Frankford.

Yocum, Stanley, Chief of Architecture & Eng., Bd. of Public Education, 405 West School House Lane, Germantown.

Pittsburgh—Bouffard, L. J., Vice-Pres. & General Mgr., Universal Testing Lab. Co., 506 Keystone Bldg.

Buente, C. F., Concrete Products Co. of America, Diamond Bank Bldg.

Craver, H. H., Mgr., Chemical Div., Pittsburgh Testing Lab., Stevenson & Locust Sts.

Douglass, Robert M., Civil & Sanitary Engr., 912 Columbia Bank Bldg.

Laboon, J. F., Director, County Dept. of Works, Allegheny County, 501 County Office Bldg.

Lanahan, Frank J., Pres., Fort Pitt Malleable Iron Co., P. O. Box 505.

Lovett, Sanford C., Supt. of Light, Bureau of Eng., 445 City-County Bldg.

Mansfield, Myron G., Vice-Pres. & Secy., Morris Knowles, Inc., 507 Westinghouse Bldg.

Palmer, I. Charles, Div. Engr., Div. of Sewers, 420 City-County Bldg.

Pittsburgh-Des Moines Steel Company, Neville Island Station.

Reppert, Charles M., Cons. Engr., 724 S. Negley Ave.

Roessing, Frank M., Director, Dept. of Public Works, 417 City-County Bldg.

Shafer, William B., Supt. of Highways & Sewers, City-County Bldg.

Saint Mary's—Williams, J. A., Vice-Pres., Saint Mary's Sewer Pipe Co.

Wilkes-Barre—Johns, Walter P., City Engr., City Hall.

Williamsport—Mussina, Lyons, City Engr., City Hall.

RHODE ISLAND

Providence—Blanchard, Arthur H., Cons. Highway Engr. & Traffic Control & Transport Consultant, Box C, Edgewood Station.

Goodrich, Robert M., Exec. Director, Providence Governmental Research Bureau, 32 Westminster St.

Woonsocket—Cote, Raymond, Comr. Public Works, City Hall.

SOUTH CAROLINA

Columbia—Tomlinson, W. S., City Engr., City Hall.

SOUTH DAKOTA

Sioux Falls—Bragstad, R. E., City Engr., City Hall.

TENNESSEE

Memphis—Field, Arthur M., Director, Industrial Div., Chamber of Commerce.

Nashville—Oldham, George E., 1226 16th Ave., S.

TEXAS

Dallas—Dalton, E. L., Cons. Engr., 803 Dallas Bank & Trust Bldg.

Ft. Worth—Hawley, John B., Cons. Civil Engr., 407 Capps Bldg.

Houston—Brown, George R., Brown & Root, Inc., 4300 Calhoun Rd.
McVea, J. C., Municipal Improvements Engr., 1318 Kipling St.
Port Arthur—Hughes, Charles W., Cons. Engr., 2147 Fifth St.
San Antonio—Sauer, August, Engr., 412 Trenton Ave.
Woodville—Kendall, Charles H., State Resident Highway Engr., Box 185.

VERMONT

Burlington—Stanley, George C., City Engr. & Supt. Streets, City Hall.

VIRGINIA

Alexandria—Haydock, Winters, 3109 Cameron Mills Rd.
Newport News—Biggins, J. C., City Mgr., City Hall.
Norfolk—George, Henry H. (III) Asst. Engr. in Charge of Services, City Hall.
Portsmouth—Weaver, Joseph F., City Engr., 2017 County St.
Richmond—Harris, A. Mason, Chief, Bureau of Streets, 217 Governor St.

WASHINGTON

Seattle—Starkweather, Walter, Div. Civil Engr., U. S. Coast Guard, Seattle Div., 308 National Bldg.

WEST VIRGINIA

Charleston—Nowlan, Hume K., Executive Secy., West Virginia League of Municipalities, Box 427.
Clarksburg—Collins, L. W., Cons. Engr., 332 Washington Ave.
Highland, Scotland G., Secy., Treas. & Gen. Mgr., Water Bd.
Lang, T. S., City Engr., City Bldg.
Martinsburg—Hoke, John B., District Engr., Interstate Amiesite Co., Stewart Bldg.
Morgantown—Prince, Elmer W., City Mgr. & City Engr., City Hall.

WISCONSIN

Beloit—Heebink, G. E., Supervising Engr., Dept. of Public Works, City Offices.
Kenosha—Grasser, Frank G., Supt. of Streets, City Hall.
Smith, Robert M., City Engr. & Director of Public Works, City Hall.
Madison—Smith, Leon A., Supt., Water Works, City Hall.
Milwaukee—Cahill, Ralph H., Village Comr., Whitefish Bay, 801 E. Lexington Blvd.
Dolge, Henry D., Street Sanitation Supervisor & Foreman, 2154 N. 60th St.
Ferebee, James L., Chief Engr. of City Sewerage Com. & County Metropolitan Sewerage Com., Box 2079.
Gettelman, Fred, Co., High Speed Snow Plows, 4400 State St.
Gundlach, George C., Dist. Office, Bureau of Agricultural Eng., P. O. 4870 N. Oakland Ave.
Heil, Julius P., Pres., The Heil Co.

Knebes, E. L., Asst. City Engr., Room 407, City Hall.
Schwada, Joseph P., City Engr., City Hall.
Townsend, Darwin W., Cons. Engr., Consoer, Townsend & Quinlan, 839 N. Marshall St.
Whitney, Charles S., Cons. Engr., 724 E. Mason St.
Racine—Gearen, M. C., Bridge Engr., Dept. of Public Works, 300 Cliff Ave.
Peirce, Walter A., Mgr., Water Dept., City Hall.
Rhinelander—Button, Joseph T., Resident Engr. & Inspector, PWA, Box 586.
Sheboygan—Boley, Arthur L., City Engr., City Hall.
Donohue, Jerry, Pres., Jerry Donohue Eng. Co., 608 N. 8th St.
Stevens Point—Jackson, M. D., City Engr., 620 Clark St.
West Allis—Wichner, Arthur L., Supt. of Public Works, City Hall.

ARGENTINA

La Plata—Grisi, Adolfo P., Jefe, Estudios y Projectos, Direccion de Pavimentacion, M. O. P., Bcia Buenos Aires.
Magliano, Hilario (Dr.) Decano de la Facultad de Ciencias Fisicomatematics, Calle 47, esquinas 1.

BRAZIL

Rio de Janeiro—Rangel, L. A. de Souza, Chief Engr., Dept. of Public Works, Rua Buenos Ayres, No. 93-3 andar.
Sao Paulo—Silva Freire, Victor da, Pres., Humus Ltd. Sewerage & Sanitary Developments, Caixa 18.

ALBERTA, CANADA

Edmonton—Haddow, A. W., City Engr., City Hall.

MANITOBA, CANADA

Winnipeg—Aldridge, William, Ass. City Engr., 333 McGee St.
Wood, E. A., Street Cleaning & Scavenging Div., Dept. of Health, City Hall Annex.

NOVA SCOTIA, CANADA

Halifax—Johnston, H. W., City Engr., City Hall.
Truro—Gordon, Murray L., Town Engr., Box 95.

ONTARIO, CANADA

Hamilton—Brennan, W. C., Pres., Brennan Paving Co., Ltd., 400 Gage Ave., North.
McFaul, William Lawrence, City Engr., Bldg. Comr., & Mgr. Water Works, City Hall.
London—Veitch, Wm. M., City Engr., City Hall.
Renfrew—Stewart, John R., Town Engr., Box 447.
St. Catharines—Lamson, B. F., City Engr., City Hall.
St. Thomas—Miller, W. C., City Engr. & Treas., City Hall.

Stratford—Riehl, W. H., City Engr., City Hall.
Toronto—Bradley, Harold D., Street Comr., 90 Albert St.
Harris, R. C., Comr. of Works, City Hall.
Macallum, Andrew F., 108 Avenue Rd.
Storrie, William, Cons. Engr., Gore & Storrie, 1130 Bay St.
Taylor, G. E., Deputy Street Comr., 90 Albert St.

QUEBEC, CANADA

Montreal—Boucher, Pierre, Secy., Dept. of Planning & Research, Montreal Metropolitan Com., 10 St. James St. W.
Parent, Arthur, Consultant to City Electrical Dept., 4935 Queen Mary Rd.
Verdun—Hadley, Henry, City Engr., City Hall.

ENGLAND

London—Dawes, J. C., Ministry of Health, Whitehall S. W. 1.

GERMANY

Frankfurt-am-Main—Schroeder, A., Weidenbornstrasse 40.

HAWAII

Honolulu—Ohrt, Frederick, Mgr. & Chief Engr., Bd. of Water Supply, P. O. Box 3347.
Rush, Benjamin F., Chief Engr., Dept. of Public Works, City Hall.

HUNGARY

Budapest—Ballo, Alfred (Dr.) Director, Dept. of Public Cleansing.

INDIA

Lallaguda (Deccan)—Mudaliar, M. C. Gajaraj, "A" Block, No. 7, O.U.B. Project, Jamai-Osmania.

JAPAN

Osaka—Shimoda, Yoshito (Dr.) Director, Osaka Municipal Hygienic Lab.

NEWFOUNDLAND

St. Johns—Mahony, J. J., City Clerk.

NEW ZEALAND

Rawene—Donnelley, L. S., Engr., Hokianga County, P. O. Box 3.

VENEZUELA

Caracas—Guardia, Carlos Alberto, Ingeniero Sanitario, Ministerio de Sanidad, Apartado 1175.

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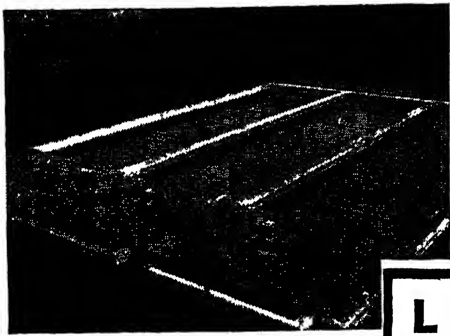

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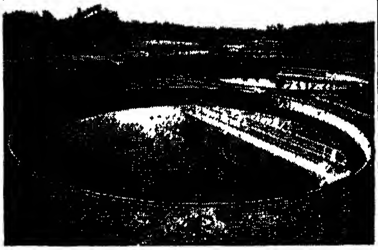

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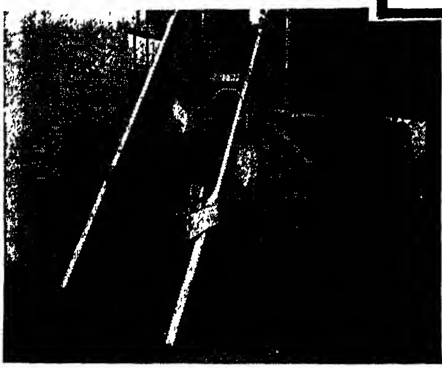

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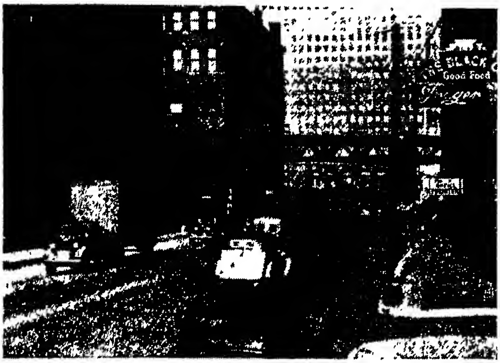

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